REVISION HISTORY			VARIATIONS FOR THIS ASSY,	FIRST USED ON: M9312		DIGITAL EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS		
CHK	ECO NO	REV		MADE BY: B CRAMM	DATE: 1 AUG 78	TITLE ROM LISTING BOOTSTRAP		
				CHECKED: N POLLITT	DATE: 17 AUG 78			
				DSN.ENG.: B GIST	DATE: 1 AUG 78	SIZE: K	CODE: SP	DOCUMENT NUMBER: M9312-0-7 / REV: A
				PROD.: D PETERSON	DATE: 3 AUG 78			
				RESP.ENG.: E CROCKER	DATE: 1 AUG 78	ASSY. #:		EDIT NO: 11

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                                M9312 BOOTSTRAP ROM LISTING

                                THIS ROM WILL BOOT THE PC11 OPTION(S)

                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y34.
                                TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y36.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                                IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                                .SBTTL  TTY BOOT
                                .SBTTL  ;PC, DL BOOT

000000  050122                  HSR:    .ASCII  "RP"            ;HIGH SPEED READER BOOT.
000002  000026                          .WORD   <HSRE-.+2>      ;OFFSET TO NEXT BOOT.
000004  000261                          SEC                     ;ENTRY
000006  012700  000000                  MOV     #0,R0           ;ENTRY POINT TO NO DIAG.
000012  012701  177550          HSRM:   MOV     #HSRCR,R1       ;LOAD CSR ADDR. INTO R1.
000016  010704                  CFUDGE: MOV     PC,R4           ;ENTRY POINT
000020  103064                          BCC     BDIAG           ;GO DO DIAG.
000022  000412                          BR      LOAD
000024  173000                          .WORD   MRESERVED
000026  000340                  HSRE:   .WORD   RESERVED
000030  052124                  TT:     .ASCII  "TT"            ;LOW SPEED READER.
000032  000146                          .WORD   <TTE-.+2>               ;OFFSET TO NEXT BOOT.
000034  000261                          SEC
000036  012700  000000                  MOV     #0,R0
000042  012701  177560          TTM:    MOV     #TTCR,R1        ;LOAD CSR ADDR. INTO R1.
000046  000763                          BR      CFUDGE
000050  012705  160000          LOAD:   MOV     #160000,R5
000054  012703  000004                  MOV     #4,R3           ;PUT ERRVEC INTO R3
000060  010723                          MOV     PC,(R3)+                ;PUT RETURN ADDR IN ERRVEC
000062  005013                          CLR     (R3)
000064  012706  000502          1$:     MOV     #502,SP
000070  010145                          MOV     R1,-(R5)        ;TIMES OUT UNTIL RIGHT ADDR!
000072  042705  000032                  BIC     #32,R5
000076  012725  016701                  MOV     #16701,(5)+
000102  012725  000026                  MOV     #26,(5)+
000106  012725  012702                  MOV     #12702,(5)+
000112  012725  000352                  MOV     #352,(5)+
000116  012725  005211                  MOV     #5211,(5)+
000122  012725  105711                  MOV     #105711,(5)+
000126  012725  100376                  MOV     #100376,(5)+
000132  012725  116162                  MOV     #116162,(5)+
000136  012725  000002                  MOV     #2,(5)+
000142  010515                          MOV     R5,(5)
000144  105025                          CLRB    (5)+
000146  005205                          INC     R5
```

```
000150  012725  005267          MOV     #5267,(5)+
000154  012725  177756          MOV     #177756,(5)+
000160  012725  000765          MOV     #765,(5)+
000164  010115                  MOV     R1,(5)
000166  000165  177746          JMP     -32(R5)         ;GO DO BOOT ADDR.=X7744
000172  000137  165564  BDIAG:  JMP     @#DIAG
000176  154747          TTE:    .WORD   154747          ;CRC WORD FOR LAST 63. WORDS.
        000001                  .END
```

SYMBOL TABLE

```
BDIAG   000172          BIT8  = 000400          BIT9  = 001000          CFUDGE  000016
CRCWD = 000000          DIAG  = 165564          HSR     000000          HSRCR = 177550
HSRE    000026          HSRM    000012          INITSW= 173024          LOAD    000050
MRESER= 173000          PC    =%000007          RESERV= 000340          RK05CR= 177404
RK06CR= 177440          RL01CR= 174400          RP03CR= 176714          RP04CR= 176700
RS03CR= 172040          RS04CR= 172040          RX01CR= 177170          RX02CR= 177170
R0    =%000000          R1    =%000001          R2    =%000002          R3    =%000003
R4    =%000004          R5    =%000005          R6    =%000006          R7    =%000007
SP    =%000006          TT      000030          TTCR  = 177560          TTE     000176
TTM     000042          TU10CR= 172522          TU16CR= 172440          TU56CR= 177342
.       = 000200
```

```
                        .TITLE  M9312 BOOTSTRAP ROM LISTING

                        THIS ROM WILL BOOT THE RKØ5 TU56 OPTION(S).

                        .SBTTL  RK05 BOOT

                        TO BOOT UNIT Ø,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                        TO BOOT UNIT Ø AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                        THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                        IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS ØØ  ADDR. 1730XX
                        IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS Ø1  ADDR. 1732XX.
                        IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 1Ø  ADDR. 1734XX.
                        IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                        .SBTTL  TU56 BOOT

                             THIS ROM WILL BOOT THE TU56 OPTION(S).
                        TO BOOT UNIT Ø,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y34.
                        TO BOOT UNIT Ø AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y36.
                        THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                        IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS ØØ  ADDR. 1730XX
                        IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS Ø1  ADDR. 1732XX.
                        IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 1Ø  ADDR. 1734XX.
                        IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                        .SBTTL  ;RKØ5, TU56 BOOT
                                ;CMNDS "DK", "DT"


                        ;RK05 BOOT.  THIS BOOT READS DISK ADDR. Ø,Ø ON ERROR I.E. DRIVE
                        ;               NOT READY,NO DISK,ETC, A SYSTEM INIT. IS ISSUED AND
                        ;               THE BOOT IS RETRIED UNTIL A GOOD BOOT OCCURS
                        ;               OR THE BOOT IS HALTED.

                        ;TU56 BOOT.     THIS BOOT READS BLOCK Ø FROM THE DEC TAPE ON ERROR
                        ;               WE ISSUE A A SYSTEM INIT. THEN TRY TO REBOOT.
                        ;               THIS RETRY WILL OCCUR UNTIL WE SUCCESSFULLY BOOT,
                        ;               OR THE BOOT IS HALTED.
                        ;

000000  042113          RKØ5:   .ASCII  "KD"            ;CMND "DK" RKØ5 BOOT.
000002  000026                  .WORD   <RK05E-.+2>     ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                  SEC                     ;UNIT Ø, NO DIAG. ENTRY POINT.
000006  012700  000000          MOV     #Ø,RØ           ;UNIT Ø, RUN DIAG. ENTRY POINT
000012  012701  177404  RKØ5M:  MOV     #RK05CR,R1      ;LOAD CSR ADDR. INTO R1.
000016  010704                  MOV     PC,R4           ;ENTRY FROM CONSOLE EMULATOR.
000020  103057                  BCC     BDIAG           ;EXERCISE DIAG. IF C=Ø
000022  000426                  BR      RK05B           ;GOTO RKØ5 BOOT.
000024  173000                  .WORD   MRESERVED
000026  000340          RK05E:  .WORD   RESERVED
000030  042124          TU56:   .ASCII  "TD"            ;CMND "DT" TU56 BOOT.
000032  000146                  .WORD   <TU56E-.+2>     ;OFFSET TO NEXT DEVICE BOOT.
000034  000261                  SEC                     ;UNIT Ø, NO DIAG. ENTRY POINT.
000036  012700  000000          MOV     #RØ,RØ          ;UNIT Ø, RUN DIAG. ENTRY POINT.
000042  012701  177342  TU56M:  MOV     #TU56CR,R1      ;LOAD CSR ADDR. INTO R1
```

```
000046  010704                          MOV     PC,R4           ;ENTRY FROM CONSOLE EMULATOR.
000050  103043                          BCC     BDIAG           ;EXERCISE DIAG. IF C=0
000052  010003                          MOV     R0,R3           ;FIX UNIT NUMBER IN R3
000054  000303                          SWAB    R3              ;TU56 BOOT.
000056  010311                          MOV     R3,(R1)         ;FIX UNIT NUMBER IN DEVICE.
000060  052711  004003                  BIS     #4003,(R1)      ;SET REWIND
000064  005711                  1$:     TST     (R1)            ;WAIT FOR END ZONE ERROR
000066  100376                          BPL     1$
000070  005761  177776                  TST     -2(R1)          ;LOOK FOR ERROR.
000074  010311                          MOV     R3,(R1)         ;CLEAR DEVICE.
000076  000410                          BR      CBOOT           ;GOTO COMMON BOOT.
000100  010003                  RK05B:  MOV     R0,R3
000102  000241                          CLC                     ;FIX UNIT NUMBER FOR DEVICE.
000104  006003                          ROR     R3
000106  006003                          ROR     R3
000110  006003                          ROR     R3
000112  006003                          ROR     R3
000114  010361  000006                  MOV     R3,6(R1)        ;SET UNIT NUMBER IN DEVICE
000120  012761  177000  000002  CBOOT:  MOV     #-512.,2(R1)    ;COMMON BOOT, SET WORD COUNT.
000126  052703  000005                  BIS     #5,R3           ;PICK UP READ WORD.
000132  010311                          MOV     R3,(1)          ;SET INTO DEVICE CSR.
000134  105711                  1$:     TSTB    (R1)            ;WAIT FOR DEVICE DONE.
000136  100376                          BPL     1$
000140  005711                          TST     (R1)            ;TEST FOR DEVICE ERROR
000142  100003                          BPL     GBOOT
000144  000005                  ERROR:  RESET                   ;ON ERROR, INITIALIZE SYSTEM
000146  000164  000002                  JMP     2(R4)           ;RETURN TO START OF BOOT.
000152  042711  000377          GBOOT:  BIC     #377,(R1)       ;NO ERROR, CLEAR DEVICE
000156  005007                          CLR     R7              ;GOTO SECONDARY MONITOR ADDR. OR
000160  000137  165564          BDIAG:  JMP     @#DIAG          ;GOTO DIAGNOSTIC IF C=0
                                                                ;RETURNS BASED ON ADDR. IN R4
                                        ;*******************************************************
                                        ;ENTRY POINT FOR RK05 UNIT #2,NO DIAGS RUN.
                                        ;*******************************************************
000164  000261                          SEC

                                        ;*******************************************************
                                        ;ENTRY POINT FOR RK05 UNIT #2, RUN DIAGS.
                                        ;*******************************************************

000166  012700  000002          RK052:  MOV     #2,R0           ;ENTRY POINT FOR RK05 BOOT UNIT 2
000172  000707                          BR      RK05M
        000176                          .=176
000176  124650                  TU56E:  .WORD   124650          ;CRC WORD FOR LAST 63. WORDS.
        000001                          .END
```

SYMBOL TABLE

```
BDIAG   000160          BIT8  = 000400          BIT9  = 001000          CBOOT   000120
CRCWD = 000000          DIAG  = 165564          ERROR   000144          GBOOT   000152
HSRCR = 177550          INITSW= 173024          MRESER= 173000          PC    =%000007
RESERV= 000340          RK05    000000          RK05B   000100          RK05CR= 177404
RK05E   000026          RK05M   000012          RK052   000166          RK06CR= 177440
RL01CR= 174400          RP03CR= 176714          RP04CR= 176700          RS03CR= 172040
RS04CR= 172040          RX01CR= 177170          RX02CR= 177170          R0    =%000000
R1    =%000001          R2    =%000002          R3    =%000003          R4    =%000004
R5    =%000005          R6    =%000006          R7    =%000007          SP    =%000006
TTCR  = 177560          TU10CR= 172522          TU16CR= 172440          TU56    000030
TU56CR= 177342          TU56E   000176          TU56M   000042          .     = 000200
```

```
                        M9312 BOOTSTRAP ROM LISTING

                             THIS ROM WILL BOOT THE RK06/RK07 OPTION(S).

        TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
        TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
        THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
        IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
        IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
        IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
        IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

        .SBTTL  RK06/RK07 BOOT

        ;RK06 BOOT.      THIS BOOT BOOOTS EITHER THE RK06 OR RK07 DRIVES.
        ;                IT FIRST TRIES TO BOOT SELECTED DRIVE AS A RK06.
        ;                IF WE GET A DRIVE TYPE ERROR AS A RESULT OF THAT TRY,
        ;                WE SET THE RK07 DRIVE TYPE IN THE RK611 CSR. AND TRY
        ;                TO BOOT THE SELECTED DRIVE AS A RK07.
        ;
        ;                NOTE: DRIVE TYPE IS LEFT IN THE
        ;                CSR WHEN WE LEAVE THIS BOOT.

        .SBTTL  ;RK06/RK07
                ;CMND = "DM"

000000  042115                  RK06:   .ASCII  "MD"            ;ID OF RK06,RK07 BOOT.
000002  000176                          .WORD   <RK06E-.+2>     ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                          SEC
000006  012700  000000                  MOV     #0,R0
000012  012701  177440          RK06M:  MOV     #RK06CR,R1      ;LOAD DEVICE ADDR. INTO R1.
000016  010704                          MOV     PC,R4
000020  103055                          BCC     BDIAG
000022  000402                          BR      RK06B
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030  010061  000010          RK06B:  MOV     R0,10(R1)
000034  012711  000003                  MOV     #3,(R1)
000040  105711                  1$:     TSTB    (R1)
000042  100376                          BPL     1$
000044  005711                          TST     (R1)
000046  100015                          BPL     3$              ;NO ERROR-THEN PRROCEED.
000050  032761  000040  000014          BIT     #40,14(R1)      ;THERE WAS AN ERROR,PUT DRIVE TYPE?
000056  001426                          BEQ     ERROR           ;NO,INIT AND TRY AGAIN.
000060  000005                          RESET                   ;YES INIT AND TRY RK07 TYPE DRIVE.
000062  010061  000010                  MOV     R0,10(R1)       ;SET DRIVE NUMBER.
000066  012711  002003                  MOV     #002003,(R1)    ;SELECT RK07,PAC.
000072  105711                  2$:     TSTB    (R1)            ;WAIT FOR READY.
000074  100376                          BPL     2$
000076  005711                          TST     (R1)            ;LOOK FOR AN ERROR
000100  100415                          BMI     ERROR           ;IF ERROR INIT TRY AGAIN.
000102                          3$:                             ;REGISTER INTO ITSELF.
000102  012761  177000  000002  CBOOT:  MOV     #-512.,2(R1)    ;LOAD WORD COUNT
000110  011103                          MOV     (R1),R3         ;READ DEVICE
000112  042703  000377                  BIC     #377,R3         ;STRIP.
```

```
000116  052703  000021                  BIS     #21,R3          ;ADD READ CODE
000122  010311                          MOV     R3,(R1)         ;START DEVICE
000124  105711                  1$:     TSTB    (R1)            ;WAIT FOR READY
000126  100376                          BPL     1$
000130  005711                          TST     (1)             ;ANY ERROR?
000132  100003                          BPL     GBOOT           ;NO ERROR, EXIT
000134  000005                  ERROR:  RESET                   ;INITIALIZE SYSTEM
000136  000164  000002                  JMP     2(4)            ;RETRY BOOT.
000142                          GBOOT:
000142  005007                  START:  CLR     PC              ;STARTS LOADED CODE.

                                        ;*********************************************************
                                        ;ENTRY POINT FOR RK06,RK07 UNIT #1, NO DIAG.
                                        ;*********************************************************
000144  000261                          SEC
                                        ;*********************************************************
                                        ;ENTRY POINT FOR RK06,RK07 UNIT #1, RUN DIAG.
                                        ;*********************************************************
000146  012700  000001                  MOV     #1,R0
000152  000717                          BR      RK06M
000154  000137  165564          BDIAG:  JMP     @#DIAG
        000176                          .=176
000176  077161                  RK06E:  .WORD   077161          ;CRC WORD FOR LAST 63. WORDS.
        000001                          .END
```

SYMBOL TABLE

```
BDIAG   000154          BIT8  = 000400          BIT9  = 001000          CBOOT   000102
CRCWD = 000000          DIAG  = 165564          ERROR   000134          GBOOT   000142
HSRCR = 177550          INITSW= 173024          MRESER= 173000          PC    =%000007
RESERV= 000340          RK05CR= 177404          RK06    000000          RK06B   000030
RK06CR= 177440          RK06E   000176          RK06M   000012          RL01CR= 174400
RP03CR= 176714          RP04CR= 176700          RS03CR= 172040          RS04CR= 172040
RX01CR= 177170          RX02CR= 177170          R0    =%000000          R1    =%000001
R2    =%000002          R3    =%000003          R4    =%000004          R5    =%000005
R6    =%000006          R7    =%000007          SP    =%000006          START   000142
TTCR  = 177560          TU10CR= 172522          TU16CR= 172440          TU56CR= 177342
.     = 000200
```

```
                                M9312 BOOTSTRAP ROM LISTING

                                     THIS ROM WILL BOOT THE RL01 OPTION(S).

                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                                TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                                IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                                .SBTTL  RL01 BOOT
                                        ;CMND = "DL"

000000  042114                  RL01:   .ASCII  "LD"            ;ID OF RL11/RL01 BOOT.
000002  000176                          .WORD   <RL01E-.+2>     ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                          SEC                     ;UNIT 0, NO DIAG. ENTRY POINT
000006  012700  000000                  MOV     #0,R0           ;UNIT 0, RUN DIAG. ENTRY POINT.
000012  012701  174400          RL01M:  MOV     #RL01CR,R1      ;LOAD CSR ADDR. INTO R1
000016  010704                          MOV     PC,R4           ;ENTRY POINT FROM CONSOLE EMULATOR.
000020  103064                          BCC     BDIAG           ;EXERCISE DIAG. FC=0
000022  000402                          BR      1$
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030  010003                  1$:     MOV     R0,R3
000032  000303                          SWAB    R3              ;ASSUME SYSTEM INIT ON ENTRY.
000034  010311                          MOV     R3,(R1)         ;SET UNIT NUMBER.
000036  012761  000013  000004          MOV     #13,4(R1)       ;CLEAR DRIVE ERROR.
000044  052703  000004                  BIS     #4,R3
000050  010311                          MOV     R3,(R1)         ;ISSUE GET STATUS.
000052  105711                  2$:     TSTB    (R1)            ;WAIT TILL DONE.
000054  100376                          BPL     2$
000056  105003                          CLRB    R3
000060  052703  000010                  BIS     #10,R3          ;ISSUE A READ HEADER.
000064  010311                          MOV     R3,(R1)
000066  105711                  3$:     TSTB    (R1)            ;WAIT TILL DONE.
000070  100376                          BPL     3$
000072  016102  000006                  MOV     6(R1),R2        ;GET HEADER.
000076  042702  000077                  BIC     #77,R2          ;CLEAR SECTOR.
000102  005202                          INC     R2
000104  010261  000004                  MOV     R2,4(R1)        ;SET SEEK TO ZERO.
000110  105003                          CLRB    R3
000112  052703  000006                  BIS     #6,R3
000116  010311                          MOV     R3,(R1)         ;DO SEEK.
000120  105711                  4$:     TSTB    (R1)            ;WAIT TILL DONE.
000122  100376                          BPL     4$
000124  005061  000004                  CLR     4(R1)           ;CLEAR DISK ADDR.
000130  012761  177000  000006          MOV     #-512.,6(R1)    ;SET WORD COUNT.
000136  105003                          CLRB    R3
000140  052703  000014                  BIS     #14,R3          ;READ DATA CMND.
000144  010311                          MOV     R3,(R1)         ;ISSUE READ CMND.
000146  105711                  5$:     TSTB    (R1)            ;WAIT TILL DONE.
000150  100376                          BPL     5$
000152  005711                          TST     (R1)            ;LOOK FOR ERRORS.
```

```
000154  100003                          BPL     GBOOT
000156  000005                  ERROR:  RESET                   ;SYSTEM INITIALIZE.
000160  000164  000002                  JMP     2(R4)
000164  042711  000377          GBOOT:  BIC     #377,(R1)               ;CLEAR RL01.
000170  005007                          CLR     R7              ;GOTO SECONDARY BOOT.
000172  000137  165564          BDIAG:  JMP     @#DIAG
        000176                          .=176
000176  174540                  RL01E:  .WORD   174540          ;CRC WORD FOR LAST 63.WORDS.
        000001                          .END
```

SYMBOL TABLE

```
BDIAG   000172          BIT8  = 000400          BIT9  = 001000          CRCWD = 000000
DIAG  = 165564          ERROR   000156          GBOOT   000164          HSRCR = 177550
INITSW= 173024          MRESER= 173000          PC    =%000007          RESERV= 000340
RK05CR= 177404          RK06CR= 177440          RL01    000000          RL01CR= 174400
RL01E   000176          RL01M   000012          RP03CR= 176714          RP04CR= 176700
RS03CR= 172040          RS04CR= 172040          RX01CR= 177170          RX02CR= 177170
R0    =%000000          R1    =%000001          R2    =%000002          R3    =%000003
R4    =%000004          R5    =%000005          R6    =%000006          R7    =%000007
SP    =%000006          TTCR  = 177560          TU10CR= 172522          TU16CR= 172440
TU56CR= 177342          .     = 000200
```

```
                                M9312 BOOTSTRAP ROM LISTING

                                     THIS ROM WILL BOOT THE RS03 OPTION(S).

                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                                TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                                IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                                .SBTTL  RS03 BOOT
                                ;CMND   DS

000000  042123                  RS03:   .ASCII  'SD'            ;IDENTIFIER 'DS' FOR RS03 BOOT.
000002  000176                          .WORD   <RS03E-.+2>     ;OFFSET TO NEXT ROM.
000004  000261                          SEC                     ;ENTRY FOR UNIT 0,NO CPU DIAG RUN.
000006  012700  000000                  MOV     #0,R0           ;ENTRY FOR UNIT 0,RUN CPU DIAG.
000012  012701  172040          RS03M:  MOV     #RS03CR,R1      ;PUT ADDR. OF CSR INTO R1.
000016  010704                          MOV     PC,R4           ;GET RETURN ADDR.,
000020  103026                          BCC     BDIAG           ;'GOTO DIAG IF ENABLED(C=0).
000022  000402                          BR      1$
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030  010003                  1$:     MOV     R0,R3
000032  010361  000010          RS03B:  MOV     R3,10(R1)       ;SET UNIT NUMBER
000036  016161  000016  000016          MOV     16(R1),16(R1)   ;WRITE ATTENTION FLAGS.
000044  012761  177000  000002          MOV     #-512.,2(R1)    ;SET WORD COUNT.
000052  012711  000071                  MOV     #71,(R1)        ;SET COMMAND READ.
000056  105711                  1$:     TSTB    (R1)            ;WAIT TILL READY.
000060  100376                          BPL     1$
000062  005711                          TST     (R1)            ;LOOK FOR ERRORS.,
000064  100401                          BMI     ERROR           ;IF ERROR,TAKE CARE OF IT.
000066  005007                          CLR     R7              ;ELSE EXIT TO LOADED CODE.,
000070  000005                  ERROR:  RESET                   ;INIT SYSTEM.
000072  000164  000002                  JMP     2(R4)
000076  000137  165564          BDIAG:  JMP     @#DIAG          ;GOTO DIAGNOSTICS
                                                                ;RETURN MADE THROU ADDR. IN R4.
000176  126075                  RS03E:  .WORD   126075  ;CRC16 WORD FOR LAST 63. WORDS.
        000001                          .END


                                        SYMBOL TABLE

BDIAG   000076          BIT8  = 000400          BIT9  = 001000          CRCWD = 000000
DIAG   165564           ERROR   000070          HSRCR = 177550          INITSW= 173024
MRESER= 173000          PC    =%000007          RESERV= 000340          RK05CR= 177404
RK06CR= 177440          RL01CR= 174400          RP03CR= 176714          RP04CR= 176700
RS03    000000          RS03B   000032          RS03CR= 172040          RS03E   000176
RS03M   000012          RS04CR= 172040          RX01CR= 177170          RX02CR= 177170
R0    =%000000          R1    =%000001          R2    =%000002          R3    =%000003
R4    =%000004          R5    =%000005          R6    =%000006          R7    =%000007
SP    =%000006          TTCR  = 177560          TU10CR= 172522          TU16CR= 172440
TU56CR= 177342          .     = 000200
```

```
                                M9312 BOOTSTRAP ROM LISTING

                                    THIS ROM WILL BOOT THE RX01 OPTION(S).

                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                                TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                                IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                                .SBTTL  RX01 BOOT
                                ;CMND   "DX"


                                ; THIS BOOT READ TRACK 1,SECTOR 1 OFF DISK.  IT CAN ONLY LOOK AT
                                ;DRIVE 0 OR DRIVE 1.
                                ;IF ANY ERROR IS ENCONTERED I.E. DRIVE OFF LINE,NO DISK,ETC,
                                ;A SYSTEM INIT. IS ISSUED AND WE TRY AGAIN TO REBOOT THE DISK.
                                ;
000000  042130          RX01:   .ASCII  "XD"            ;CMND "DX" RX01 BOOT.
000002  000176                  .WORD   <RX01E-.+2>     ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                  SEC                     ;UNIT 0, NO DIAG
000006  012700  000000          MOV     #0,R0           ;UNIT 0 RUN
000012                  RX01M:                          ;ENTRY FROM CONSOLE EMULATOR
000012  012701  177170          MOV     #RX01CR,R1      ;GET CSR ADDR TO R1
000016  010704                  MOV     PC,R4
000020  103056                  BCC     BDIAG           ;EXERCISE DIAG. IF C=D
000022  000402                  BR      1$
000024  173000                  .WORD   MRESERVED       ;
000026  000340                  .WORD   RESERVED        ;
000030  000241          1$:     CLC
000032  012703  001407  RX01B:  MOV     #1407,R3
000036  132700  000001          BITB    #1,R0
000042  001402                  BEQ     1$
000044  012703  011427          MOV     #11427,R3
000050  132711  100040  1$:     BITB    #100040,(R1)    ;IS DONE BIT SET?
                                ;
000054  001775                  BEQ     1$
000056  110311                  MOVB    R3,(R1)         ;LOAD READ CMND.
000060  111105          2$:     MOVB    (R1),R5         ;IS 'TR' BIT SET?
000062  100376                  BPL     2$
000064  112761  000001  000002  MOVB    #1,2(R1)        ;LOAD TRACK,SECTOR ADDR.
000072  106003                  RORB    R3
000074  102771                  BVS     2$
000076  032711  100040  3$:     BIT     #100040,(R1)    ;WAIT FOR ERROR OR DONE.
000102  001775                  BEQ     3$
000104  100412                  BMI     ERROR
000106  000303                  SWAB    R3
000110  110311                  MOVB    R3,(R1)
000112  005003                  CLR     R3
000114  105711          4$:     TSTB    (R1)
000116  100376                  BPL     4$
000120  116123  000002          MOVB    2(R1),(R3)+
```

```
000124  105703                          TSTB    R3              ;ALL DONE READS?
000126  100372                          BPL     4$              ;NO GET NEXT BYTE
000130  005007                          CLR     PC              ;START CODE
000132  000005                  ERROR:  RESET
000134  000140  012700  000001          M1:     MOV     #1,R0           ;ENTER HERE TO BOOT
                                        ;                       ;UNIT #1 WITHOUT DIAG.
000144  000261                          SEC
000146  000721                          BR      RX01M
000150  012700  000001          M2:     MOV     #1,R0           ;ENTER HERE TO BOOT
                                        ;                       ;UNIT #1 WITH DIAG. RUN.
000154  000716                          BR      RX01M
000156  000137  165564          BDIAG:  JMP     @#DIAG
000176  105572                  RX01E:  .WORD   105572
        000001                  .END
```

SYMBOL TABLE

```
BDIAG   000156          BIT8  = 000400          BIT9  = 001000          CRCWD = 000000
DIAG  = 165564          ERROR   000132          HSRCR = 177550          INITSW= 173024
MRESER= 173000          M1      000140          M2      000150          PC    =%000007
RESERV= 000340          RK05CR= 177404          RK06CR= 177440          RL01CR= 174400
RP03CR= 176714          RP04CR= 176700          RS03CR= 172040          RS04CR= 172040
RX01    000000          RX01B   000032          RX01CR= 177170          RX01E   000176
RX01M   000012          RX02CR= 177170          R0    =%000000          R1    =%000001
R2    =%000002          R3    =%000003          R4    =%000004          R5    =%000005
R6    =%000006          R7    =%000007          SP    =%000006          TTCR  = 177560
TU10CR= 172522          TU16CR= 172440          TU56CR= 177342          .     = 000200
```

```
                        .TITLE  M9312 BOOTSTRAP ROM LISTING
                        .REM    %

                        COPYRIGHT (C) 1977,1978
                        DIGITAL EQUIPMENT CORP.
                        MAYNARD, MASS. 01754

                        PROGRAM BY EDWARD C. BADGER

                                ;THIS BOOT BOOTS THE RX02 FLOOPY DISK FORM COMMAND "DY"
                                ;
                                ;THE SECOUNDAY BOOT MUST BE IN DISK TRACK 1
                                ;SECTORS 1,3,5, AND 7 IF ANY SECTOR IS UNSED,IT STILL WILL BE READ.
                                ;NOTE :   SINGLE DENSITY WILL BOOT 256 WORDS STARTING AT
                                ;       LOC 0
                                                ;DOUBLE DENSITY WILL BOOT 1000 WORDS,STARTING
                                ;       LOC 0.
                                ;
                             THIS ROM WILL BOOT THE RX02 OPTION(S).
                        TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                        TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                        THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                        IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                        IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                        IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                        IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                        .SBTTL  RX02 BOOT
                                ;
                                ;
000000  042131                  .ASCII  "YD"            ;ASSCI IDENTIFIER FOR THIS BOOT  "DY"
000002  000176                  .WORD   <RX02E-.+2>     ;OFFFSET TO NEXT DEVICE BOOT.
000004  000261                  SEC                     ;ENTRY POINT FOR NOT DIAG RUN.
000006  012700  000000          MOV     #0,R0           ;ENTRY POINT TO RUN DIAG.
000012  012701  177170          MOV     #RX02CR,R1      ;PUT CSR ADDR.  IN R1
000016  010704          L6:     MOV     PC,R4           ;RECORD BOOT ADDR.
000020  103064                  BCC     BDIAG           ;IF ENABLED ,RUN DIAG.
000022  000402                  BR      1$              ;CONTINUE PAST POWER UP RESERVED LCO
000024  173000                  .WORD   MRESERVED       ;POWER UP HERE FOR NEW PC.
000026  000340                  .WORD   RESERVED        ;POWER UP HERE FOR NOW STATUS WORD
000030                  1$:
000030  005103          L62:    COM     R3              ;CHANGE STATE OF DENSITY BIT.
000032  000005                  RESET                   ;SYSTEM INITAILIZE.
000034  012704  000401          MOV     #401,R4         ;TRACK,SECTOR INFO.
000040  005002          L7:     CLR     R2              ;START ADDR. 0
000042  012705  000200          MOV     #200,R5         ;IF ALREADY SET,CLEAR IT.
000046  042703  177377          BIC     #^C<BIT8>,R3    ;CLEAR OUT ALL BUT DENSITY INFORMATION.
000052  001001                  BNE     LL6             ;IF SET,DOUBLE DENSITY.
000054  006205                  ASR     R5              ;IF CLEAR, IT WAS SINGLE DENSITY,MUST
000056                  LL6:                            ;HALF THE WORD COUNT.
000056                  LL:
000056  050700                  BIS     PC,R0           ;R0 WILL CONTAIN EITHER A ZERO OR A ONE.
                                                        ;BY ADDING THE PC AND THE NEXT OFFSET,WE
                                                        ;COME UP WITH THHE ADDRESS OF THE BYTE THAT
                                                        ;CONTAINS THE START CODE FOR EITHER UNIT 0
```

```
                                                        ;OR UNIT ONE.
000060  156003  000036          BISB    READ-.(R0),R3 ;READ EITHER "007" FOR UNIT 0 OR "027" FOR UNIT 1.
000064  040700                  BIC     PC,R0         ;RESTORE R0 TO UNIT NUMBER.
000066  010706                  MOV     PC,R6         ;RECORD WHERE WE ARE FOR RETURN.
000070  000423                  BR      WAIT          ;WAIT UNIT UNIT IS READY.
000072  000432                  BR      RDDY          ;SET READ SECTOR
000074  000416                  BR      WAITS         ;GIVE SECOTR INFORAMATION.
000076  000415                  BR      WAITS         ;GIVE TRACK INFORMATION.
000100  000425                  BR      EMPTY
000102  000430                  BR      WAITD         ;GIVE WORD  COUNT
000104  000407                  BR      WAITD2        ;GIVE CURRENT ADDR.
000106  060502                  ADD     R5,R2         ;UPDATE CUURRENT ADDR.
000110  060502                  ADD     R5,R2
000112  122424                  CMPB    (R4)+,(R4)+   ;UPDATE SECTOR NUMBER.
000114  120427                  CMPB    R4,(PC)+      ;IF THE LAST SECTOR IS #7,READ
                                                      ;ONE MORE SECTOR. IF GREATOR (OCTAL 11) THEN
                                                      ;THEN WE'LL EXIT.
000116     007     027  READ:   .BYTE   7,27          ;THE #7 IN LOWER BYTE FOR LAST INSTR. AND
                                                      ;THESE LOCATIONS ALSO USED BY PREVOUS
                                                      ;INSTR. AS DATA FOR UNIT 1 OR UNIT 2
                                                      ;READ SECTOR WITH UNIT NUMBER.
000120  003756                  BLE     LL            ;READS SECTORS 1,3,5,7
000122  005007                  CLR     R7            ;EXIT TO LOC ZERO
000124  010261  000002  WAITD2: MOV     R2,2(R1)      ;LOAD CURRENT ADDR.
000130  000403                  BR      WAIT
000132  110461  000002  WAITS:  MOVB    R4,2(R1)      ;LOAD TRACK OR SECTOR INFO.
000136  000304                  SWAB    R4
000140  032711  100240  WAIT:   BIT     #100240,(R1)  ;LOOK FOR ERROR,T/R OR DONE.
000144  001775                  BEQ     WAIT          ;IF NONE,LOOP
000146  100730                  BMI     L62           ;IF ERROR,RESART.
000150  005726                  TST     (6)+          ;FIX REURN ADDR.
000152  000116                  JMP     (6)           ;RETURN FROM WHERE YE CAME.
000154  042703  000004  EMPTY:  BIC     #4,R3
000160  010311          RDDY:   MOV     R3,(R1)
000162  000766                  BR      WAIT
000164  110561  000002  WAITD:  MOVB    R5,2(R1)      ;STORE WORD COUNT IN DBR
000170  000763                  BR      WAIT          ;WAIT TILL DONE.
000172  000137  165564  BDIAG:  JMP     @#DIAG
000176  057141          RX02E:  .WORD   057141        ;CRC-16 WORD FOR THIS BOOOT.
        000001                  .END
```

SYMBOL TABLE

```
BDIAG   000172          BIT8  = 000400          BIT9  = 001000          CRCWD = 000000
DIAG  = 165564          EMPTY   000154          HSRCR = 177550          INITSW= 173024
LL      000056          LL6     000056          L6      000016          L62     000030
L7      000040          MRESER= 173000          PC    =%000007          RDDY    000160
READ    000116          RESERV= 000340          RK05CR= 177404          RK06CR= 177440
RL01CR= 174400          RP03CR= 176714          RP04CR= 176700          RS03CR= 172040
RS04CR= 172040          RX01CR= 177170          RX02CR= 177170          RX02E   000176
R0    =%000000          R1    =%000001          R2    =%000002          R3    =%000003
R4    =%000004          R5    =%000005          R6    =%000006          R7    =%000007
SP    =%000006          TTCR  = 177560          TU10CR= 172522          TU16CR= 172440
TU56CR= 177342          WAIT    000140          WAITD   000164          WAITD2  000124
WAITS   000132          .     = 000200
```

```
                                M9312 BOOTSTRAP ROM LISTING

                                THIS ROM WILL BOOT THE TU10 OPTION(S).

                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                                TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                                IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                                %
                                .SBTTL  ;TU10 BOOT      BOOTS UNITS 0,1,OR 2
                                        ;CMND = MT      WITH OR WITHOUT DIAGNOSTICS


000000  046524                  TU10:   .ASCII  "TM"            ;TM11/TU10 BOOT
000002  000176                          .WORD   <TU10E-.+2>     ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                          SEC                     ;ENTRY POINT TO UNIT 0 NO DIAG.
000006  012700  000000                  MOV     #0,R0           ;ENTRY POINT TO DIAGNOSTICS
000012  012701  172522          TU10M:  MOV     #TU10CR,R1      ;LOAD CSR ADDR INTO R1.
000016  010704                          MOV     PC,R4           ;ENTRY POINT
000020  103054                          BCC     BDIAG
000022  000411                          BR      1$              ;GOTO BOOT.
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030  012700  000001                  MOV     #1,R0           ;START UNIT #1 DIAGNOSTICS
000034  000766                          BR      TU10M
000036  012700  000001                  MOV     #1,R0           ;START UNIT #1 NO DIAGNOSTICS
000042  000261                          SEC
000044  000762                          BR      TU10M
000046  010003                  1$:     MOV     R0,R3
000050  000303                  TU10B:  SWAB    R3
000052  010311                          MOV     R3,(R1)         ;FIX UNIT #
000054  006061  177776          1$:     ROR     -2(R1)          ;SEE IF THE SELECTED DRIVE IS ON LINE
000060  103375                          BCC     1$              ;WAIT IF NOT.
000062  052711  060017          2$:     BIS     #60017,(R1)     ;REWIND, 800 BPI 9 CHANNEL
000066  105711                  3$:     TSTB    (R1)            ;WAIT TILL DONE
000070  100376                          BPL     3$
000072  012761  177777  000002          MOV     #-1,2(R1)       ;SET RECORD COUNTER TO SKIP ONE RECORD
000100  112711  000011                  MOVB    #11,(R1)        ;SPACE FORWARD CMND.
000104  105711                  4$:     TSTB    (R1)            ;WAIT FOR ERROR OR READY
000106  100376                          BPL     4$
000110  005711                          TST     (R1)            ;SEE IF ERROR
000112  100415                          BMI     ERROR
000114  012761  177000  000002  CBOOT:  MOV     #-512.,2(R1)    ;LOAD WORD COUNT
000122  011103                          MOV     (R1),R3         ;SET READ
000124  042703  000377                  BIC     #377,R3
000130  152703  000003                  BISB    #3,R3
000134  010311                          MOV     R3,(R1)
000136  105711                  1$:     TSTB    (1)             ;WAIT TILL DONE
000140  100376                          BPL     1$
000142  005711                          TST     (R1)            ;TEST FOR ERRORS.
000144  100004                          BPL     GBOOT           ;NO - ERRROR - EXIT.
```

```
000146  000005                  ERROR:  RESET                   ;ELSE, INITIALIZE, TRY AGAIN.
000150  000720                          BR      TU10M
000152  000137  165564          BDIAG:  JMP     @#DIAG
000156  042711  000377          GBOOT:  BIC     #377,(R1)       ;CLEAR CONTROLLER.
000162  005007                          CLR     PC              ;GO TO SECONDARY BOOT.
        000176                          .=176
000176  021526                  TU10E:  .WORD   021526
        000001                          .END
```

SYMBOL TABLE

```
BDIAG   000152          BIT8  = 000400          BIT9  = 001000          CBOOT   000114
CRCWD = 000000          DIAG  = 165564          ERROR   000146          GBOOT   000156
HSRCR = 177550          INITSW= 173024          MRESER= 173000          PC    =%000007
RESERV= 000340          RK05CR= 177404          RK06CR= 177440          RL01CR= 174400
RP03CR= 176714          RP04CR= 176700          RS03CR= 172040          RS04CR= 172040
RX01CR= 177170          RX02CR= 177170          R0    =%000000          R1    =%000001
R2    =%000002          R3    =%000003          R4    =%000004          R5    =%000005
R6    =%000006          R7    =%000007          SP    =%000006          TTCR  = 177560
TU10    000000          TU10B   000050          TU10CR= 172522          TU10E   000176
TU10M   000012          TU16CR= 172440          TU56CR= 177342          .     = 000200
```

```
                                M9312 BOOTSTRAP ROM LISTING

                                     THIS ROM WILL BOOT THE TU16/TU77 OPTION(S).

                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                                TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                                IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                                %
                                .SBTTL  ;TU16/TU77 BOOT
                                        ;CMND = "MM"

000000  046515                  TU16:   .ASCII  "MM"             ;TU16 BOOT.
000002  000176                          .WORD   <TU16E-.+2>      ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                          SEC                      ;UNIT ZERO ENTRY
000006  012700  000000                  MOV     #0,R0
000012  012701  172440          TU16M:  MOV     #TU16CR,R1       ;LOAD CSR ADDR. INTO R1
000016  010704                          MOV     PC,R4
000020  103064                          BCC     BDIAG
000022  000402                          BR      TU16B
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030                          TU16B:
000030  000005                  TU16ER: RESET
000032  010003                          MOV     R0,R3
000034  052703  001300                  BIS     #1300,R3         ;800 BPI AND FORMAT
000040  010361  000032                  MOV     R3,32(R1)
000044  032761  010000  000012  1$:     BIT     #10000,12(R1)
000052  001774                          BEQ     1$
000054  112711  000007                  MOVB    #7,(R1)          ;REWIND COMMAND
000060  105761  000012          2$:     TSTB    12(R1)
000064  100375                          BPL     2$
000066  112711  000011                  MOVB    #11,(R1)         ;DRIVE CLEAR CMND.
000072  105761  000012          3$:     TSTB    12(R1)
000076  100375                          BPL     3$
000100  012761  177777  000006          MOV     #-1,6(R1)
000106  112711  000031                  MOVB    #31,(R1)         ;SPACE FORWARD CMND.
000112  105761  000012          4$:     TSTB    12(R1)
000116  100375                          BPL     4$
000120  016161  000016  000016          MOV     16(R1),16(R1)
000126  012761  177000  000002  CMM$GO: MOV     #-512.,2(R1)
000134  011103                          MOV     (R1),R3
000136  042703  000377                  BIC     #377,R3
000142  152703  000071                  BISB    #71,R3           ;READ CMND
000146  010311                          MOV     R3,(R1)
000150  105711                  1$:     TSTB    (R1)
000152  100376                          BPL     1$
000154  005711                          TST     (R1)
000156  100004                          BPL     CLCRS
000160  022761  001000  000014          CMP     #1000,14(R1)     ;PATTERN TO TEST FRAME ERROR BIT
000166  001320                          BNE     TU16ER
```

```
000170  005007                  CLCRS:  CLR     PC
000172  000137  165564          BDIAG:  JMP     @#DIAG
        000176                          .=176
000176  162556                  TU16E:  .WORD   162556
        000001                          .END
```

SYMBOL TABLE

```
BDIAG   000172          BIT8  = 000400          BIT9  = 001000          CLCRS   000170
CMM$GO  000126          CRCWD = 000000          DIAG  = 165564          HSRCR = 177550
INITSW= 173024          MRESER= 173000          PC    =%000007          RESERV= 000340
RK05CR= 177404          RK06CR= 177440          RL01CR= 174400          RP03CR= 176714
RP04CR= 176700          RS03CR= 172040          RS04CR= 172040          RX01CR= 177170
RX02CR= 177170          R0    =%000000          R1    =%000001          R2    =%000002
R3    =%000003          R4    =%000004          R5    =%000005          R6    =%000006
R7    =%000007          SP    =%000006          TTCR  = 177560          TU10CR= 172522
TU16    000000          TU16B   000030          TU16CR= 172440          TU16E   000176
TU16ER  000030          TU16M   000012          TU56CR= 177342          .     = 000200
```

```
                                M9312 BOOTSTRAP ROM LISTING

                                     THIS ROM WILL BOOT THE TU60 OPTION(S).

                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                                TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                                IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                                %
                                .SBTTL  ;THIS TA-11,TU60 CASSETTE BOOT.
                                        ;CMMD = CT

000000  041524                  TA11:   .ASCII  "TC"            ;TU60 BOOT ID "CT"
000002  000176                          .WORD <TA11E-.+2>               ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                          SEC                     ;UNIT #0 ENTRY, NO DIAG
000006  012700  000000                  MOV     #0,R0           ;UNIT #0 ENTRY, RUN DIAG
000012  012701  177500          TA11M:  MOV     #177500,R1      ;LOAD CSR ADDR IN R1
000016  010704                          MOV     PC,R4           ;RETURN ADDR.
000020  103042                          BCC     BDIAG           ;GOT DIAG. IF ENABLED.
000022  000402                          BR      1$
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030  010003                  1$:     MOV     R0,R3
000032  042703  177776          TA11B:  BIC     #177776,R3      ;STRIP JUNK, ONLY UNIT 0 OR 1.
000036  000303                          SWAB    R3              ;PUT IN CORRECT POS.
000040  010311                          MOV     R3, (R1)        ;LOAD UNIT #
000042  010405                          MOV     R4,R5
000044  042705  000177                  BIC     #177,R5
000050  062705  000132                  ADD     #TABLE,R5
000054  012702  000375                  MOV     #375,R2         ;XFERR COUNT.
000060  112503                          MOVB    (R5)+,R3        ;SET COMPARITOR.
000062  112511                  LOOP1:  MOVB    (R5)+,(R1)      ;LEAD COMMAND.
000064  100407                          BMI     DONE            ;WATCH FOR LAST COMMAND.
000066  130311                  LOOP2:  BITB    R3,(R1)         ;LOOK FOR DONE BIT
000070  001776                          BEQ     LOOP2
000072  105202                          INCB    R2
000074  100772                          BMI     LOOP1
000076  116112  000002                  MOVB    2(R1),(R2)
000102  000771                          BR      LOOP2
000104  005711                  DONE:   TST     (R1)            ;ANY ERRORS?
000106  100404                          BMI     ERROR
000110  005002                          CLR     R2
000112  120312                          CMPB    R3,(R2)         ;CORRECT CODE IN LOC 0?
000114  001001                          BNE     ERROR
000116  005007                          CLR     PC
000120  000005                  ERROR:  RESET
000122  000164  000002                  JMP     2(R4)
000126  000137  165564          BDIAG:  JMP     @#DIAG
000132    240    037    015     TABLE:  .BYTE   240,37,15,5,24,224
   005    024    224
                                .EVEN
```

```
        000176  022763                  TA11E:  .WORD   022763
                000001                  .END
```

SYMBOL TABLE

```
BDIAG   000126          BIT8  = 000400          BIT9  = 001000          CRCWD = 000000
DIAG  = 165564          DONE    000104          ERROR   000120          HSRCR = 177550
INITSW= 173024          LOOP1   000062          LOOP2   000066          MRESER= 173000
PC    =%000007          RESERV= 000340          RK05CR= 177404          RK06CR= 177440
RL01CR= 174400          RP03CR= 176714          RP04CR= 176700          RS03CR= 172040
RS04CR= 172040          RX01CR= 177170          RX02CR= 177170          R0    =%000000
R1    =%000001          R2    =%000002          R3    =%000003          R4    =%000004
R5    =%000005          R6    =%000006          R7    =%000007          SP    =%000006
TABLE   000132          TA11    000000          TA11B   000032          TA11E   000176
TA11M   000012          TTCR  = 177560          TU10CR= 172522          TU16CR= 172440
TU56CR= 177342          .     = 000200
```

```
                        M9312 BOOTSTRAP ROM LISTING

                        THIS ROM WILL BOOT THE RP02/RP03 OPTION(S).

                        TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                        TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                        THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                        IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                        IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                        IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                        IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                             THIS ROM WILL BOOT THE RP04/RP05 OPTION(S).

                        TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y46.
                        TO BOOT UNIT 0 AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y50.
                        THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                        IF THIS ROM IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                        IF THIS ROM IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                        IF THIS ROM IS IN SLOT 3 THE Y COMPONENT IS 10  ADDR. 1734XX.
                        IF THIS ROM IS IN SLOT 4 THE Y COMPONENT IS 11  ADDR. 1736XX.

                        .SBTTL  ;BOOT FOR RP02, RP03,   RP04, RP05
                                ;CMND = "DP"            CMND = "DB"
000000  042120                  RP03:   .ASCII  "PD"            ;ID OF RP02, RP03 BOOT.
000002  000042                          .WORD   <RP03E-.+2>     ;OFFSET TO NEXT DEVICE BOOT.
000004  000261                          SEC                     ;UNIT 0, NO DIAG ENTRY POINT.
000006  012700  000000                  MOV     #0,R0           ;UNIT 0, RUN DIAG ENTRY POINT.
000012  012701  176714          RP03M:  MOV     #RP03CR,R1      ;LOAD CSR ADDR. INTO R1.
000016  010704                          MOV     PC,R4           ;ENTRY FROM CONDOLE EMULATOR.
000020  103060                          BCC     BDIAG           ;EXERCISE DIAG. IF C=0.
000022  000402                          BR      1$
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030  010003                  1$:     MOV     R0,R3
000032  000303                          SWAB    R3
000034  010311                          MOV     R3,(R1)         ;LOAD UNIT #.
000036  012702  000005                  MOV     #5,R2           ;CODE FOR READ.
000042  000425                  RP03E:  BR      CM$GO           ;GOTO COMMON BOOT CODE.
                                        ;NEW HEADER BLOCK BEGINS HERE
000044  042102                  RP04:   .ASCII  "BD"            ;ID OF RP04, RP05 BOOT.
000046  000132                          .WORD   <REND-.+2>      ;OFFSET TO NEXT DEVICE BOOT.
000050  000261                          SEC                     ;UNIT 0, NO DIAG. ENTRY POINT.
000052  012700  000000                  MOV     #0,R0           ;UNIT 0, RUN DIAG. ENTRY POINT.
000056  012701  176700          RP04M:  MOV     #RP04CR,R1      ;LOAD CSR ADDR. INTO R1.
000062  010704                          MOV     PC,R4           ;ENTRY FROM CONSOLE EMULATOR.
000064  103036                          BCC     BDIAG           ;EXERCISE DIAG IF C=0.
000066  010061  000010                  MOV     R0,10(R1)       ;SET UNIT NUMBER.
000072  012702  000071                  MOV     #71,R2          ;CODE FOR READ.
000076  012711  000021                  MOV     #21,(R1)        ;ISSUE READ IN PRESET CMND.
000102  012761  014000  000032          MOV     #14000,32(R1)   ;SET FMT22 AND ECC INHIBIT BITS
000110  016161  000016  000016          MOV     16(R1),16(R1)   ;WRITE ATTENTION SUMMARY REG.
                                                                ;INTO ITSELF.
000116  012761  177000  000002  CM$GO:  MOV     #-512.,2(R1)    ;LOAD WORD COUNT.
```

```
000124  011103                          MOV     (R1),R3         ;GET CSR CONTENTS.
000126  042703  000377                  BIC     #377,R3
000132  050203                          BIS     R2,R3           ;SET NEW COMMAND.
000134  010311                          MOV     R3,(R1)
000136  105711                  1$:     TSTB    (R1)            ;WAIT FOR READY.
000140  100376                          BPL     1$
000142  005711                          TST     (R1)            ;LOOK FOR ERRORS.
000144  100003                          BPL     CLRGO           ;NONE - CONTINUE
000146  000005                  ERROR:  RESET                   ;IF ERROR, INITIALIZE SYSTEM
000150  000164  000002                  JMP     2(4)
000154  042711  000377          CLRGO:  BIC     #377,(R1)       ;CLEAR DEVICE (LOW BYTE)
000160  005007                          CLR     R7              ;AWAY WE GO TO THE NEWLY LOADED CODE!
000162  000137  165564          BDIAG:  JMP     @#DIAG          ;GOTO DIAGNOSTICS.
                                        ;*******************************************************
                                        ;RP02,RP03 ENTRY FOR UNIT #1, NO DIAG
                                        ;*******************************************************
000166  000261                          SEC
                                        ;*******************************************************
                                        ;RP02,RP03 ENTRY FOR UNIT #1, RUN DIAG.
                                        ;*******************************************************
000170  012700  000001                  MOV     #1,R0
000174  000706                          BR      RP03M
        000176                          .=176
000176  111612                  REND:   .WORD   111612
        000001                          .END
```

SYMBOL TABLE

```
BDIAG   000162          BIT8  = 000400          BIT9  = 001000          CLRGO   000154
CM$GO   000116          CRCWD = 000000          DIAG  = 165564          ERROR   000146
HSRCR = 177550          INITSW= 173024          MRESER= 173000          PC    =%000007
REND    000176          RESERV= 000340          RK05CR= 177404          RK06CR= 177440
RL01CR= 174400          RP03    000000          RP03CR= 176714          RP03E   000042
RP03M   000012          RP04    000044          RP04CR= 176700          RP04M   000056
RS03CR= 172040          RS04CR= 172040          RX01CR= 177170          RX02CR= 177170
R0    =%000000          R1    =%000001          R2    =%000002          R3    =%000003
R4    =%000004          R5    =%000005          R6    =%000006          R7    =%000007
SP    =%000006          TTCR  = 177560          TU10CR= 172522          TU16CR= 172440
TU56CR= 177342          .     = 000200
```

```
                                00100   ;<11-UTILITIES>TSBOOT.P11.145,  8-NOV-78 12:53:44, EDIT BY KINZELMAN
                                00200   .TITLE  TSBOOT - TS04 M9312 BOOTSTRAP CODE (ROM PART # 23-764A9)
                                00300   .REM    !       BY PAUL KINZELMAN
                                00400                   ML1-3 E63
                                00500                   3-2473
                                00600                   27-JUN-78
                                00700
                                00800   THIS IS THE M9312 BOOTSTRAP CODE FOR THE TS04 MAG TAPE DRIVE, WRITTEN
                                00900   TO CONFORM TO SPEC # ECB1-77-001-00-U BY ED BADGER (10 OCT 77).
                                01000
                                01100   THIS BOOTSTRAP MUST BE LOCATED IN THE 1ST 32K AREA OF THE ADDRESS SPACE.
                                01200
                                01300   THE MAGTAPE MUST HAVE A SINGLE RECORD OR FILE MARK BEFORE THE DESIRED
                                01400   BOOTSTRAP RECORD, AND THE BOOTSTRAP RECORD MUST BE 512(10) BYTES LONG.
                                01500
                                01600   THE BOOTSTRAP DOES THE FOLLOWING OPERATIONS:
                                01700           OP              IF OK, DO       IF ERR, DO
                                01800   1       SET CHAR        2               2
                                01900   2       REWIND          3               1
                                02000   3       RD FWD (TP MK)  4               1
                                02100   4       READ FWD        EXIT            5
                                02200   5       RD PREV REV RTY EXIT            1
                                02300
                                02400   ENTER BOOT IN THE STANDARD WAY (R0 = UNIT #, R1 = TSSR BUS ADR).
                                02500   SINCE THE TS04 HAS 1 UNIT PER ADDRESS, THE UNIT # IS ROTATED LEFT 2 PLACES
                                02600   AND ADDED TO THE BUS ADR IN R1:
                                02700           MS#     TSSR ADR
                                02800        (DEFAULT)  172522
                                02900           0       172522
                                03000           1       172526
                                03100           2       172532          (ETC.)
                                03200           3       172536
                                03300
                                03400   UPON EXIT FROM THE BOOT, R1 CONTAINS THE ADDRESS OF THE TSSR REG,
                                03500   R2 CONTAINS THE TSBA REG, AND R0 LO BYTE CONTAINS THE UNIT NUMBER.
                                03600   IF YOU SUBTRACT 20 FROM R4, R4 WILL POINT TO THE ASCII ID OF THE DEVICE.
                                03700   THEREBY YOU CAN FIGURE OUT FROM WHAT MTA TYPE YOU WERE BOOTED FROM.
                                03800
                                03900   FOR THOSE OF YOU WHO KNOW NOTHING ABOUT THE TS04, HERE IS A CHEAT-SHEET.
                                04000   THE TSSR REG CONTAINS THE SSR (SUBSYSTEM RDY) BIT INDICATING THAT THE
                                04100   DRIVE IS RDY FOR THE NEXT COMMAND. THE TSSR ALSO CONTAINS THE SC (SPECIAL
                                04200   CONDITION) BIT INDICATING THAT SOMETHING ABNORMAL (USUALLY ERROR) HAPPENED
                                04300   DURING THE LAST OPERATION. TO DO AN OPERATION, WE WAIT FOR THE SSR BIT
                                04400   TO COME TRUE. WE THEN WRITE THE ADDRESS OF THE COMMAND PACKET WE WISH
                                04500   TO PERFORM INTO THE TSBA. WHEN SSR COMES TRUE AGAIN, WE CHECK
                                04600   THE SC BIT TO TELL US WHETHER ANYTHING UNUSUAL HAPPENED.
                                04700
                                04800   THE ADDRESS OF THE COMMAND PACKET MUST BE ON AN EVEN 4 WORD BOUNDARY (THE
                                04900   LO ORDER 2 BITS ARE 0). BIT 17 OF THE PACKET ADR IS MOVED TO BIT 1 OF
                                05000   THE POINTER AS WRITTEN INTO THE TSBA AND BIT 16 OF THE PACKET ADR IS
                                05100   MOVED TO BIT 0 OF THE POINTER.
                                05200   AND A FREE DINNER TO THE FIRST ONE TO COME UP WITH A SHORTER BOOTSTRAP
                                05300   THAN THIS ONE THAT DOES THE EQUIVALENT OPERATIONS!
                                
000000                          00100           .ASECT
```

```
 56                                     00200          .ENABL ABS
 57                                     00300
 58            172522                   00400          TS04SR= 172522          ;FIRST TS04 STATUS REG (TSBA IS PREV WD)
 59            165564                   00500          DIAG=   165564
 60            022000                   00600          .=22000         ;FOR NOW
 61                                     00700
 62  022000    046523                   00800  TS04:   .ASCII  "SM"            ;ASCII CODE (BACKWARDS)
 63  022002    000176                   00900          .WORD   <CRCWD-.+2>     ;OFFSET TO NEXT DEVICE
 64  022004    000261                   01000          SEC                     ;ENTRY POINT TO UNIT 0 NO DIAG
 65  022006    012700  000000           01100          MOV     #0,R0           ;ENTRY POINT TO DIAGNOSTICS
 66  022012    012701  172522           01200  TS04M:  MOV     #TS04SR,R1      ;GET THE 1ST TSSR ADR IN R1
 67  022016    010704                   01300          MOV     PC,R4           ;ENTRY POINT, SAVE RTN PC
 68  022020    103063                   01400          BCC     BDIAG           ;BR TO RUN DIAGNOSTICS
 69  022022    000411                   01500          BR      RSTRT           ;BR OVER RESERVED WORDS
 70  022024    173000                   01600          .WORD   173000          ;THE VOICE FROM ABOVE SAID THESE
 71  022026    000340                   01700          .WORD   340             ;WORDS HAD TO BE HERE
 72                                     01800                                  ;(XXX24 IS EXCEPTION ADDRESS)
 73                                     01900  ;MOVE THE FOLLOWING TO 1000:
 74  022030    142010                   02000  CMPRWD: 142010          ;REWIND (1 WD)
 75  022032    000000                   02100          0               ;LO 16 BITS ADR
 76  022034    000000                   02200          0               ;HI 2 BITS ADR
 77  022036    001000                   02300          256.*2          ;SIZE OF RECORD (512(10) BYTES)
 78                                     02400
 79  022040    140004                   02500  CMPSCH: 140004          ;SET CHARACTERISTICS CMD (4 WDS)
 80  022042    001012                   02600          1012            ;LO 16 BITS OF MSG BUFF POINTER (= .)
 81  022044    000000                   02700          0               ;HI 2 BITS
 82                                     02800
 83                                     02900          ;THE FOLLOWING MUST NOT BE MOVED AWAY FROM THE END OF THE CMD LIST
 84                                     03000                          ;THE FOLLOWING IS ALSO TAKEN AS THE MSG
 85                                     03100                          ;BUFFER POINTER SIZE AND MBF SIZE:
 86  022046    010003                   03200  RSTRT:  MOV     R0,R3           ;COPY THE UNIT #
 87                                     03300                          ;THE FOLLOWING IS TAKEN AS THE DRV CHAR-
 88                                     03400                          ;ACTERISTICS WORD:
 89  022050    010702                   03500          MOV     PC,R2           ;GET WHERE WE ARE
 90  022052    012705  001022           03600          MOV     #1022,R5        ;END OF COMMAND LST IN CORE
 91  022056    014245                   03700  1$:     MOV     -(R2),-(R5)     ;MOVE IN THE COMMAND LIST
 92  022060    105705                   03800          TSTB    R5              ;ARE WE DONE YET?
 93  022062    001375                   03900          BNE     1$              ;LOOP FOR ALL WDS (EXIT WITH R5 = 1000)
 94  022064    006303                   04000          ASL     R3              ;ROTATE INTO PLACE
 95  022066    006303                   04100          ASL     R3              ;SO WE CAN ADD IT TO THE ADR
 96                                     04200  ;NOTE: THE FOLLOWING ASSUMES THE USER TYPED A REASONABLE NUMBER FOR
 97                                     04300  ;THE UNIT. IF NOT, WE WILL PROBABLY GET A BUSS TIMEOUT.
 98  022070    060301                   04400          ADD     R3,R1           ;ADD IN TO THE BUS ADR
 99  022072    010102                   04500          MOV     R1,R2           ;COPY THE TS STATUS REG
100  022074    005742                   04600          TST     -(R2)           ;POINT R2 TO THE TSBA
101  022076    105711                   04700  2$:     TSTB    (R1)            ;AND CHK FOR SSR
102  022100    100376                   04800          BPL     2$              ;BR IF SSR NOT UP YET
103                                     04900
104                                     05000          ;THE FOLLOWING MAY BE REMOVED IF WE NEED THE SPACE:
105  022102    005037  000000           05100          CLR     @#0             ;CLR OUT LOC 0 IN CASE BOOT FAILED WE'LL HALT
106
107  022106    012712  001010           00100          MOV     #1010,(R2)      ;DO THE SET CHARACTERISTICS
108  022112    111103                   00200  3$:     MOVB    (R1),R3         ;TST SSR BIT (INIT R3 BYTE TO NEG WHEN RDY)
109  022114    100376                   00300          BPL     3$              ;BR IF NOT RDY YET
110                                     00400                          ;DON'T NEED TO CHK ERRS BECAUSE IF IT FAILED,
```

```
111                                     00500                   ;THE NEXT COMMAND WILL CERTAINLY FAIL ANYWAY
112                                     00600
113  022116  010512                     00700   LP1:    MOV     R5,(R2)         ;DO THE REWIND OR RD FWD OVER TAPE MARK
114  022120  105711                     00800   4$:     TSTB    (R1)            ;TST SSR BIT
115  022122  100376                     00900           BPL     4$              ;BR IF NOT RDY YET
116  022124  032711  000012             01000           BIT     #12,(R1)        ;ALLOW TERM CLASS 0 AND 4, CHK FOR OTHERS
117  022130  001346                     01100           BNE     RSTRT           ;BR IF ERROR, TRY AGN
118  022132  012715  140001             01200           MOV     #140001,(R5)    ;CODE FOR RD FWD AS NEXT OPERATION
119  022136  105103                     01300           COMB    R3              ;INVERT OUR FLG
120  022140  100366                     01400           BPL     LP1             ;BR BACK TO DO THE RD OVER TAPE MARK
121                                     01500
122  022142  010512                     01600   LP2:    MOV     R5,(R2)         ;DO RD FWD THE BOOT RECORD (R5=1000)
123  022144  105711                     01700   6$:     TSTB    (R1)            ;TST SSR BIT
124  022146  100376                     01800           BPL     6$              ;BR IF NOT RDY YET
125  022150  005711                     01900           TST     (R1)            ;TST SC BIT
126  022152  100401                     02000           BMI     RDBAD           ;BR IF ERROR, DO RETRY
127  022154  005007                     02100           CLR     PC              ;JMP TO LOC 0
128                                     02200
129  022156  012715  161001             02300   RDBAD:  MOV     #161001,(R5)    ;CODE FOR RD PREV REV RETRY
130  022162  105103                     02400           COMB    R3              ;INVERT OUR FLG
131  022164  100366                     02500           BPL     LP2             ;LOOP BACK FOR RD RETRY
132  022166  000727                     02600           BR      RSTRT           ;BR TO TRY WHOLE THING AGN
133                                     02700
134  022170  000137  165564             02800   BDIAG:  JMP     @#DIAG  ;LINK TO DIAGNOSTICS
135  022174  000000                     02900           HALT                    ;THIS IS A SPARE LOCATION
136             001                     03000   .IF LT  176-<.&376>
137                                     03100   .ERROR  .       ;BOOTSTRAP CODE OVERFLOW
138             000                     03200   .ENDC
139  022176  140726                     03300   CRCWD:  140726                  ;CRC FOR BOOTSTRAP
140             000001                  03400           .END
BDIAG   022170          CRCWD   022176          LP2     022142          TS04    022000          .       = 022200
CMPRWD  022030          DIAG  = 165564          RDBAD   022156          TS04M   022012
CMPSCH  022040          LP1     022116          RSTRT   022046          TS04SR= 172522
. ABS.  022200     000
```

```
                                ;M9312 BOOTSTRAP ROM LISTING
                                ;
                                ;THIS ROM WILL BOOT THE TU58 OPTION
                                ;
                                ;TO BOOT UNIT 0, AND NOT RUN DIAGNOSTICS THE START ADDR IS 173Y04
                                ;TO BOOT UNIT 0, AND RUN CPU DIAGNOSTICS THE START ADDR IS 173Y06
                                ;THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WORD
                                ;IF THE ROM IS IN SLOT 1 THE Y COMPONENT IS 00 ADDR. 1730XX
                                ;IF THE ROM IS IN SLOT 2 THE Y COMPONENT IS 01 ADDR. 1732XX
                                ;IF THE ROM IS IN SLOT 3 THE Y COMPONENT IS 10 ADDR. 1734XX
                                ;IF THE ROM IS IN SLOT 4 THE Y COMPONENT IS 11 ADDR. 1736XX

                                .SBTTL TU58 BOOT

                                ;*********************************************************************
                                ;***  NOTE: THIS BOOTSTRAP DOES NOT RETRY IF THE BOOT FAILS.
                                ;***        THIS IS NECESSARY BECAUSE RETRIES CAN DAMAGE THE
                                ;***        TAPE CARTRIDGE IF A HARDWARE FAILURE HAS OCCURRED.
                                ;*********************************************************************
        165564                          DIAG=   165564
        173000                          MRESERVED       =173000
        000340                          RESERVED        =340
        0125025                                 CRC     =125025
        176500                          TI$CSR  =176500
        176502                          TI$BFR  =176502
        176504                          TO$CSR  =176504
        176506                          TO$BFR  =176506
000000  042104                  TU58:   .ASCII  "DD"            ;ASCII IDENTIFIER
000002  000176                          .WORD   <TU58E-.+2>     ;OFFSET TO NEXT BOOT
000004  000261                          SEC                     ;ENTRY POINT FOR UNIT 0 NO DIAGS
000006  012700  000000                  MOV     #0,R0           ;ENTRY POINT FOR UNIT 0 WITH DIAGS
000012  012701  176500          TU58M:  MOV     #TI$CSR,R1      ;PUT DEVICE ADDRESS IN R1
000016  010704                          MOV     PC,R4           ;DIAGNOSTIC BOILER PLATE
000020  103054                          BCC     BDIAG
000022  000402                          BR      TBOOT
000024  173000                          .WORD   MRESERVED
000026  000340                          .WORD   RESERVED
000030  012706  002000          TBOOT:  MOV     #2000,SP        ;SET STACK POINTER
000034  005004                          CLR     R4
000036  012702  176504                  MOV     #TO$CSR,R2
000042  005212                          INC     @R2             ;SEND BREAK ON SERIAL LINE
000044  005003                          CLR     R3
000046  004767  000046                  JSR     PC,SEND8        ;DELAY 7 CHARACTER TIMES
000052  005012                          CLR     @R2             ;REMOVE BREAK
000054  005737  176502                  TST     @#TI$BFR        ;DUMP RECEIVE REGISTER
000060  012703                          MOV     (PC)+,R3        ;GET INIT, BOOT FLAGS
000062     004     010                  .BYTE   4,10
000064  004767  000034                  JSR     PC,SEND2        ;SEND FLAGS
000070  010003                          MOV     R0,R3
000072  004767  000030                  JSR     PC,SEND1        ;SEND UNIT NUMBER
000076  005003                          CLR     R3              ;SET ADDRESS POINTER TO 0
000100  105711                  RCVLOP: TSTB    @R1             ;WAIT FOR CHARACTER RECEIVED
```

```
 53 000102  100376                    BPL     RCVLOP
 54 000104  113723  176502             MOVB    @#TI$BFR,(R3)+  ;STORE CHARACTER IN MEMORY
 55 000110  022703  001000             CMP     #1000,R3        ;512 BYTES  RECEIVED?
 56 000114  101371                    BHI     RCVLOP          ;NO, LOOP
 57 000116  005007                    CLR     PC              ;YES, JUMP TO 0

 58                          ;SUBROUTINE TO OUTPUT CHARACTERS TO THE SERIAL LINE
 59
 60
 61 000120  004717            SEND8:  JSR     PC,@PC          ;SEND 8 CHARACTERS
 62 000122  004717                    JSR     PC,@PC          ;SEND 4 CHARACTERS
 63 000124  004717            SEND2:  JSR     PC,@PC          ;SEND 2 CHARACTERS
 64 000126  105712            SEND1:  TSTB    @R2             ;TEST TRANSMIT READY
 65 000130  100376                    BPL     SEND1
 66 000132  110337  176506             MOVB    R3,@#TO$BFR     ;SEND CHARACTER
 67 000136  000303                    SWAB    R3
 68 000140  000207                    RTS     PC
 69
 70                          ;ENTRY FOR UNIT 1
 71
 72 000142  000261            UNIT1:  SEC                     ;UNIT 1 NO DIAGS
 73 000144  012700  000001    UNIT1D: MOV     #1,R0           ;UNIT 1 NO DIAGS
 74 000150  000720                    BR      TU58M           ;
 75
 76 000152  000137  165564    BDIAG:  JMP     @#DIAG          ;LINK TO DIAGNOSTIC ADDRESS
 77
 78         000176'                   .=      <TU58+176>
 79 000176  022540            TU58E:  .WORD   CRC
 80         000001                    .END
SYMBOL TABLE

BDIAG   000152R         RCVLOP  000100R         SEND8   000120R         TO$BFR= 176506          TU58M   000012R
CRC   = 022540          RESERV= 000340          TBOOT   000030R         TO$CSR= 176504          UNIT1   000142R
DIAG  = 165564          SEND1   000126R         TI$BFR= 176502          TU58    000000R         UNIT1D  000144R
MRESER= 173000          SEND2   000124R         TI$CSR= 176500          TU58E   000176R

. ABS.  000000     000
        000200     001
```

```
                        .REM    %


                                        IDENTIFICATION
                                        --------------

                        PRODUCT CODE:       XXXXXXX-XX-XXXXX-X-X

                        PRODUCT NAME:       M9312 DECNET BOOT - DMC

                        PRODUCT DATE:       APRIL 1978

                        MAINTAINER:         DIAGNOSTIC ENGINEERING

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                %


                .REM    %
                     THIS ROM WILL BOOT THE DMC OPTION.
                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                TO BOOT UNIT 0,AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                TO BOOT UNIT 1,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y30.
                TO BOOT UNIT 1,AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y32.
                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                IF ROM #1 IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                IF ROM #1 IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                %
```

```
                                .TITLE  M9312 DECNET BOOT - DMC
                                ;       BASIC DEFINITIONS
                        000000  R0=%0
                        000001  R1=%1
                        000002  R2=%2
                        000003  R3=%3
                        000004  R4=%4
                        000005  R5=%5
                        000006  R6=%6
                        000007  R7=%7
                        000006  SP=%6
                        000007  PC=%7
                        000340  RESERVED=340
                        165564  DIAG=165564
                        173024  INITSW=173024
                        000000  CRCWD=0
                        173000  MRESERVED=173000
                                .NLIST  MC,MD
                                .LIST   ME


000000                                  .ENABL  ABS
020000                          .=20000
```

```
 1
 2                                      ;CMND           XM
 3
 4 020000     115     130       DMCBGN: .ASCII  'MX'            ;IDENTIFIER 'XM' FOR DMC BOOT
 5 020002  000576                       .WORD   <DMCE-.+2>      ;OFFSET TO NEXT BOOT
 6 020004  000261                       SEC                     ;ENTRY FOR UNIT 0, NO CPU DIAG RUN
 7 020006  012700  000000               MOV     #0,R0           ;ENTRY FOR UNIT 0, RUN CPU DIAG
 8 020012  012701  160010       DMCM:   MOV     #160010,R1      ;PUT FLOATING BASE ADDR IN R1
 9 020016  010704                       MOV     PC,R4           ;GET RETURN ADDR
10 020020  103015                       BCC     BDIAG           ;GO TO DIAG IF ENABLED (C=0)
11 020022  000416                       BR      SETSTK
12 020024  173000                       .WORD   MRESERVED
13 020026  000340                       .WORD   RESERVED
14 020030  000261                       SEC                     ;ENTRY FOR UNIT 1, NO CPU DIAG RUN
15 020032  012700  000001               MOV     #1,R0           ;ENTRY FOR UNIT 1, RUN CPU DIAG
16 020036  000765                       BR      DMCM
17                                     ;*******************************************************
18                                     ;* FLOATING DEVICE INTERRUPT ROUTINE
19                                     ;*******************************************************
20 020040  005202       NODEV:  INC     R2              ;UPDATE R2 TO POINT TO NEXT DEV MODULO
21 020042  005303               DEC     R3              ;SUB ONE FROM R3
22 020044  100002               BPL     1$              ;IF CANT FIND DEVICE, HALT
23 020046  000000       2$:     HALT                    ;       ***NOTE***
24 020050  000776               BR      2$              ;REVIEW FLOATING ADDRESS ASSIGNMENTS
25 020052  000002       1$:     RTI                     ;RETURN
26                                     ;*******************************************************
27                                     ;* GO TO DIAG
28                                     ;*******************************************************
29 020054  000137  165564       BDIAG:  JMP     @#DIAG          ;GO TO DIAG
30                                                             ;RETURN MADE THROUGH ADDR IN R4
31                                     ;*******************************************************
32                                     ;* SET UP REQUEST SECONDARY BOOT MESSAGE AND STACK
33                                     ;*******************************************************
34 020060  012706  017776       SETSTK: MOV     #17776,SP       ;SET REQ SECOND BOOT MSG POINTER
35 020064  012716  000001               MOV     #1,(SP)         ;SET HIGH ORDER WORD OF MESSAGE
36 020070  012746  006010               MOV     #6010,-(SP)     ;SET LOW ORDER WORD OF MESSAGE
37                                                             ;       ***NOTE***
38                                                             ;BOOT MSG= 10,14,1,0
39                                                             ;STACK POINTER IS SET AT 17774
40                                     ;*******************************************************
41                                     ;* FIND THE DEVICE IN FLOATING SPACE
42                                     ;* VERIFY THAT TWO EXTENSION ROMS ARE PROPERLY INSTALLED
43                                     ;*******************************************************
44 020074  010702       2$:     MOV     PC,R2           ;SET UP R2 WITH
45 020076  062702  000422               ADD     #DEVTAB-2$-2,R2 ;POINTER TO DEVTAB
46 020102  010704       3$:     MOV     PC,R4           ;SET UP R4 WITH
47 020104  062704  177734               ADD     #NODEV-3$-2,R4  ;POINTER TO TRAP ROUTINE
48                                                             ;       ***NOTE***
49                                                             ;THE NEXT FOUR INSTRUCTIONS VERIFY THAT
50                                                             ;THE EXTENSION ROMS ARE PROPERLY INSTALLED.
51                                                             ;IF NOT, THE BOOT WILL HALT
52 020110  011246               MOV     (R2),-(SP)      ;PUSH THE #7407 FROM ROM #3 ON THE STACK
53 020112  166416  000200       SUB     200(R4),(SP)    ;SUBTRACT FROM IT THE #2400 OFF ROM #2
54 020116  022726  005007       CMP     #5007,(SP)+     ;COMP IT WITH #5007
55 020122  001402               BEQ     4$              ;IF NOT EQUAL, HALT
```

```
 56 020124  000000                5$:     HALT                    ;       ***NOTE***
 57 020126  000776                        BR      5$              ;CHECK POS OF ROMS #2 AND #3
 58 020130  012703  000004        4$:     MOV     #4,R3           ;SET R3 TO DMC POS IN FLOAT -2
 59 020134  010423                        MOV     R4,(R3)+        ;SET TRAP ROUTINE ADDR IN LOC 4
 60 020136  005013                        CLR     (R3)            ;CLR NEW PSW, R3 NOW CONTAINS DMC POS(6)
 61 020140  005711                FLOAT:  TST     (R1)            ;TEST FOR DEVICE, MAYBE TRAP TO NODEV
 62 020142  111204                        MOVB    (R2),R4         ;MODULO INCREMENT
 63 020144  060401                        ADD     R4,R1           ;UPDATE ADDRESS
 64 020146  005201                        INC     R1              ;BY MODULO
 65 020150  040401                        BIC     R4,R1           ;IN TABLE
 66 020152  005703                        TST     R3              ;IS THIS A DMC?
 67 020154  001371                        BNE     FLOAT           ;NOT YET
 68                                ;*******************************************************
 69                                ;* ADD UNIT DISPLACEMENT TO UNIT 0 CSR ADDR
 70                                ;*******************************************************
 71 020156  042700  177760                BIC     #177760,R0      ;PREVENT TRYING TO BOOT UNIT # > 15
 72 020162  010046                        MOV     R0,-(SP)        ;SAVE UNIT # FOR SECONDARY BOOT
 73 020164  006300                        ASL     R0              ;UNIT # TIMES 2
 74 020166  006300                        ASL     R0              ;UNIT # TIMES 4
 75 020170  006300                        ASL     R0              ;UNIT # TIMES 8
 76 020172  060001                        ADD     R0,R1           ;CSR ADDR + UNIT*8
 77 020174  000402                        BR      DMC             ;GO TO MAINLINE CODE
 78 020176  161040                        .WORD   161040          ;CRC16 WORD FOR ROM #1
 79 020200  177776                        .WORD   -2              ;HEADER WORD FOR ROM #2
 80                                ;*******************************************************
 81                                ;* DMC MAINLINE
 82                                ;*******************************************************
 83 020202  012704  000010        DMC:    MOV     #8.,R4          ;SET RETRY COUNT
 84 020206  000005                        RESET                   ;MASTER CLEAR DMC
 85 020210  010702                        MOV     PC,R2           ;RETURN ADDR
 86 020212  000461                        BR      DMCIN           ;INPUT TO DMC
 87 020214  000043                        .WORD   43              ;RQI + BASE REQUEST
 88 020216  017370                        .WORD   17370           ;BASE ADDR
 89 020220  000000                        .WORD   0               ;NO RESUME
 90 020222  000402                        BR      1$
 91 020224  173000                        .WORD   MRESERVED
 92 020226  000340                        .WORD   RESERVED
 93 020230  010702                1$:     MOV     PC,R2           ;SET RETURN ADDRESS
 94 020232  000451                        BR      DMCIN           ;INPUT TO DMC
 95 020234  000041                        .WORD   41              ;RQI + CNTLI
 96 020236  000000                        .WORD   0               ;FILLER
 97 020240  002400                        .WORD   2400            ;MAINT MODE + HDX
 98 020242  010702                DMCRCV: MOV     PC,R2           ;SET RETURN ADDR
 99 020244  000444                        BR      DMCIN           ;INPUT TO DMC
100 020246  000044                        .WORD   44              ;RQI + BA.CC + RCV
101 020250  000000                        .WORD   0               ;BUFFER ADDRESS
102 020252  007774                        .WORD   4092.           ;SET SIZE TO MAX FOR CRC-16
103 020254  010705                        MOV     PC,R5           ;SET NON-ZERO AS R5 FLAG (RCV PENDING)
104 020256  010702                DMCXMT: MOV     PC,R2           ;SET RETURN ADDR
105 020260  000436                        BR      DMCIN           ;INPUT TO DMC
106 020262  000040                        .WORD   40              ;RQI + BA/CC + XMIT
107 020264  017774                        .WORD   17774           ;MESSAGE ADDR
108 020266  000004                        .WORD   4               ;MESSAGE LENGTH
109 020270  012702  000017                MOV     #15.,R2         ;LARGE LOOP COUNTER
```

```
110 020274  105761  000002          1$:     TSTB    2(R1)           ;TEST RDYO SET
111 020300  100002                          BPL     2$              ;NOT YET
112 020302  010703                          MOV     PC,R3           ;SET RETURN ADDR
113 020304  000456                          BR      DMCOUT          ;CHECK DMC REQUEST
114 020306  005705                  2$:     TST     R5              ;IS RECEIVE STILL OUTSTANDING
115 020310  001754                          BEQ     DMCRCV          ;NO, REISSUE ONE
116 020312  005300                          DEC     R0              ;DECREMENT SHORT LOOP
117 020314  001367                          BNE     1$              ;AGAIN
118 020316  005302                          DEC     R2              ;DECREMENT LONG LOOP
119 020320  001365                          BNE     1$              ;AGAIN
120 020322  005304                          DEC     R4              ;DECREMENT RETRY COUNT
121 020324  001354                          BNE     DMCXMT          ;SEND AGAIN
122 020326  010702                          MOV     PC,R2           ;RETURN ADDR
123 020330  000412                          BR      DMCIN           ;FORCE PROC ERR-SET BASE AGAIN-KILLS DTR
124 020332  000043                          .WORD   43              ;RQI + BASE REQUEST
125 020334  017370                          .WORD   17370           ;BASE ADDRESS AGAIN
126 020336  000000                          .WORD   0               ;NO RESUME
127 020340  012703  000012          HNGLOP: MOV     #10.,R3         ;LONG LOOP COUNTER-HOLD DTR DOWN
128 020344  005300                  1$:     DEC     R0              ;DECREMENT SHORT LOOP
129 020346  001376                          BNE     1$              ;AGAIN
130 020350  005303                          DEC     R3              ;DECREMENT LONG LOOP
131 020352  001374                          BNE     1$              ;AGAIN
132 020354  000712                          BR      DMC             ;HUNG UP LONG ENOUGH-ANSWER AGAIN
133                                 ;*******************************************************
134                                 ;* DMC REQUEST INPUT ROUTINE
135                                 ;*******************************************************
136 020356  005722                  DMCIN:  TST     (R2)+           ;POINT TO FIRST PARAMETER WORD
137 020360  112211                          MOVB    (R2)+,(R1)      ;COMMAND TO DMC
138 020362  005202                          INC     R2              ;TO NEXT PARAMETER WORD
139 020364  105711                  DMCTST: TSTB    (R1)            ;IS RDYI SET?
140 020366  100411                          BMI     RDYIOK          ;YES-OK
141 020370  105761  000002                  TSTB    2(R1)           ;IS RDYO SET?
142                                                                 ;       ***NOTE***
143                                                                 ;IF HUNG IN LOOP, IS SW7 OF SW PACK #2 ON?
144 020374  000402                          BR      1$
145 020376  114076                          .WORD   114076          ;CRC16 WORD FOR ROM #2
146 020400  177776                          .WORD   -2              ;HEADER WORD FOR ROM #3
147 020402  100370                  1$:     BPL     DMCTST          ;NO,WAIT
148 020404  010703                          MOV     PC,R3           ;SET RETURN ADDR
149 020406  000415                          BR      DMCOUT          ;CHECK DMC REQUEST
150 020410  000765                          BR      DMCTST          ;WAIT TILL DMC IS READY
151                                 ;*******************************************************
152                                 ;* DMC LOAD INPUT ROUTINE
153                                 ;*******************************************************
154 020412  012261  000004          RDYIOK: MOV     (R2)+,4(R1)     ;TO FIRST HALF DMC PORT
155 020416  012261  000006                  MOV     (R2)+,6(R1)     ;TO SECOND HALF DMC PORT
156 020422  000402                          BR      2$
157 020424  173000                          .WORD   MRESERVED
158 020426  000340                          .WORD   RESERVED
159 020430  042711  000040          2$:     BIC     #40,(R1)        ;CLEAR RQI-GIVE TO DMC
160 020434  105711                  1$:     TSTB    (R1)            ;TEST RDYI CLEAR
161 020436  100776                          BMI     1$              ;NOT YET
162 020440  000112                          JMP     (R2)            ;RETURN
```

```
                                        ;*********************************************************
                                        ;* DMC OUTPUT READY ROUTINE
                                        ;*********************************************************
020442  132761  000003  000002  DMCOUT: BITB    #3,2(R1)          ;BA/CC OR CRL REQUEST
020450  001013                          BNE     1$                ;CTL REQUEST
020452  132761  000004  000002          BITB    #4,2(R1)          ;XMIT OR RCV
020460  001413                          BEQ     2$                ;XMIT COMPLETE
020462  005005                          CLR     R5                ;RECEIVE COMPLETE SET NON PENDING FLAG
020464  005715                          TST     (R5)              ;CHECK FOR CODE 0,LOAD 0 AT LOC 0
020466  001010                          BNE     2$                ;RECEIVED MESSAGE NO GOOD
020470  012600                          MOV     (SP)+,R0          ;RETURN UNIT # TO R0
020472  000005                          RESET                     ;CLEAR DMC-11
020474  000137  000006                  JMP     @#6               ;AND JUMP TO LOADED PROGRAM
020500  032761  001730  000006  1$:     BIT     #1730,6(R1)       ;FATAL ERROR?
020506  001314                          BNE     HNGLOP            ;YES,START AGAIN AFTER TIME DELAY
020510  105061  000002          2$:     CLRB    2(R1)             ;CLEAR RDYO-THROW AWAY INFO
020514  000163  000002                  JMP     2(R3)             ;RETURN
                                        ;*********************************************************
                                        ;* FLOATING DEVICE MODULO TABLE
                                        ;*********************************************************
020520      007                 DEVTAB: .BYTE   7                 ;DJ11 DEVICE MODULUS
020521      017                         .BYTE   17                ;DH11
020522      007                         .BYTE   7                 ;DQ11
020523      007                         .BYTE   7                 ;DU11
020524      007                         .BYTE   7                 ;DUP11
020525      007                         .BYTE   7                 ;LK11-A
020526      007                         .BYTE   7                 ;DMC11
020527      000                         .BYTE   0                 ;FILLER
                                                                  ;       ***NOTE***
                                                                  ;THE NEXT 23 WORDS ARE ZERO FILLED
020576  060100              DMCE:   .WORD   060100                ;CRC16 WORD FOR ROM #3
                                        ;*********************************************************
                                        ;* RELOCATION ROUTINE
                                        ;*********************************************************
020600                              .=20600
020600  012702  020000                  MOV     #20000,R2
020604  012703  030000                  MOV     #30000,R3
020610  012223              2$:     MOV     (R2)+,(R3)+
020612  020227  020576                  CMP     R2,#20576
020616  001401                          BEQ     1$
020620  000773                          BR      2$
020622  000000              1$:     HALT
000001                              .END
```

SYMBOL TABLE

```
BDIAG   020054          DMCBGN  020000          DMCRCV  020242          INITSW= 173024          RESERV= 000340
CRCWD = 000000          DMCE    020576          DMCTST  020364          MRESER= 173000          R6    =%000006
DEVTAB  020520          DMCIN   020356          DMCXMT  020256          NODEV   020040          R7    =%000007
DIAG  = 165564          DMCM    020012          FLOAT   020140          RDYIOK  020412          SETSTK  020060
DMC     020202          DMCOUT  020442          HNGLOP  020340
```

```
                                .REM    %



                                                IDENTIFICATION
                                                --------------

                                PRODUCT CODE:       XXXXXXX-XX-XXXXX-X-X

                                PRODUCT NAME:       M9312 DECNET BOOT - DU11

                                PRODUCT DATE:       APRIL 1978

                                MAINTAINER:         DIAGNOSTIC ENGINEERING

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                                %
```

```
                                .REM    %
                                     THIS ROM WILL BOOT THE DU OPTION.
                                TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                                TO BOOT UNIT 0,AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                                TO BOOT UNIT 1,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y30.
                                TO BOOT UNIT 1,AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y32.
                                THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                                IF ROM #1 IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                                IF ROM #1 IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                                %


                                .TITLE  M9312 DECNET BOOT - DU11
                                ;       BASIC DEFINITIONS

        000000                  R0=%0
        000001                  R1=%1
        000002                  R2=%2
        000003                  R3=%3
        000004                  R4=%4
        000005                  R5=%5
        000006                  R6=%6
        000007                  R7=%7
        000006                  SP=%6
        000007                  PC=%7
        000340                  RESERVED=340
        165564                  DIAG=165564
        173024                  INITSW=173024
        000000                  CRCWD=0
        173000                  MRESERVED=173000
        000226                  SSYN=226
        000220                  DLE=220
        000337                  ASYN=337
        000201                  SOH=201
        000005                  ENQ=005
        120001                  POLY=120001
                                .NLIST  MC,MD
                                .LIST   ME


000000                                  .ENABL  ABS
        020000                          .=20000
```

```
                                        ;*******************************************************
                                        ;* CMND XW (DU11)
                                        ;*******************************************************
020000     125     130          DUBGN:  .ASCII  'UX'            ;IDENTIFIER 'XU' FOR DU11 BOOT
020002  000576                         .WORD   <ENDBOO-.+2>    ;OFFSET TO NEXT BOOT
020004  000261                         SEC                     ;ENTRY FOR DU11, NO CPU DIAG RUN
020006  012700  000000                 MOV     #0,R0           ;ENTRY FOR DU11, RUN CPU DIAG
020012  012701  160010          EMDU:   MOV     #160010,R1      ;PUT FLOATING BASE ADDR IN R1
020016  010704                         MOV     PC,R4           ;GET RETURN ADDR
020020  103015                         BCC     BDIAG           ;GO TO DIAG IF ENABLED (C=0)
020022  000416                         BR      SETSTK
020024  173000                         .WORD   MRESERVED
020026  000340                         .WORD   RESERVED
020030  000261                         SEC                     ;ENTRY FOR UNIT 1, NO CPU DIAG RUN
020032  012700  000001                 MOV     #1,R0           ;ENTRY FOR UNIT 1, RUN CPU DIAG
020036  000765                         BR      EMDU
                                        ;*******************************************************
                                        ;* FLOATING DEVICE INTERRUPT ROUTINE
                                        ;*******************************************************
020040  005202          NODEV:  INC     R2              ;UPDATE R2 TO POINT TO NEXT DEV MODULO
020042  005303                  DEC     R3              ;SUB ONE FROM R3
020044  100002                  BPL     1$              ;IF CANT FIND DEVICE, HALT
020046  000000          2$:     HALT                    ;       ***NOTE***
020050  000776                  BR      2$              ;REVIEW FLOATING ADDRESS ASSIGNMENTS
020052  000002          1$:     RTI                     ;RETURN
                                        ;*******************************************************
                                        ;* GO TO DIAG
                                        ;*******************************************************
020054  000137  165564  BDIAG:  JMP     @#DIAG          ;GO TO DIAG
                                                        ;RETURN MADE THROUGH ADDR IN R4
                                        ;*******************************************************
                                        ;* FIND THE DEVICE IN FLOATING SPACE
                                        ;*******************************************************
020060  012706  017776  SETSTK: MOV     #17776,SP       ;SET UP STACK
020064  042700  177760          BIC     #177760,R0      ;PREVENT TRYING TO BOOT UNIT # > 15
020070  010016                  MOV     R0,(SP)         ;SAVE UNIT NUM AT 17776
020072  010702          2$:     MOV     PC,R2           ;SET UP R2 WITH
020074  062702  000466          ADD     #DEVTAB-2$-2,R2 ;POINTER TO DEVTAB
020100  010704          3$:     MOV     PC,R4           ;SET UP R4 WITH
020102  062704  177736          ADD     #NODEV-3$-2,R4  ;POINTER TO TRAP ROUTINE
                                                        ;       ***NOTE***
                                                        ;THE NEXT FOUR INSTRUCTIONS VERIFY THAT
                                                        ;THE EXTENSION ROMS ARE PROPERLY INSTALLED.
                                                        ;IF NOT, THE BOOT WILL HALT
020106  011246                  MOV     (R2),-(SP)      ;PUSH THE #7407 FROM ROM #3 ON THE STACK
020110  166416  000202          SUB     202(R4),(SP)    ;SUBTRACT FROM IT THE #1775 OFF ROM #2
020114  022726  005412          CMP     #5412,(SP)+     ;COMP IT WITH #5412
020120  001402                  BEQ     4$              ;IF NOT EQUAL, HALT
020122  000000          5$:     HALT                    ;       ***NOTE***
020124  000776                  BR      5$              ;CHECK POS OF ROMS #2 AND #3
020126  012703  000006  4$:     MOV     #6,R3           ;TRAP PS ADDR
020132  005013                  CLR     (R3)            ;CLR NEW PSW
020134  010443                  MOV     R4,-(R3)        ;SET TRAP ROUTINE ADDR IN LOC 4
```

```
                        DEC     R3              ;R3 CONTAINS DU11 POS IN FLOAT SPACE
FLOAT:  TST     (R1)            ;TEST FOR DEVICE, MAYBE TRAP TO NODEV
        MOVB    (R2),R4         ;MODULO INCREMENT
        ADD     R4,R1           ;UPDATE ADDRESS
        INC     R1              ;BY MODULO
        BIC     R4,R1           ;IN TABLE
        TST     R3              ;IS THIS A THE ONE?
        BNE     FLOAT           ;NOT YET
;*************************************************
;* ADD UNIT DISPLACEMENT TO UNIT 0 CSR ADDR
;*************************************************
        ASL     R0              ;UNIT # TIMES 2
        ASL     R0              ;UNIT # TIMES 4
        ASL     R0              ;UNIT # TIMES 8
        ADD     R0,R1           ;CSR ADDR + UNIT*8
;*************************************************
;* SETUP TO SEND MESSAGE
;*************************************************
SNDREQ: MOV     #17400+<8.*4>,SP        ;SET STACK ADDR-17400+8 TIMES LOOP DEC.
SNDRQ1: MOV     PC,R4           ;SET UP R4 WITH
        BR      3$
        .WORD   025174          ;CRC16 WORD FOR ROM #1
        .WORD   -2              ;HEADER WORD FOR ROM #2
3$:     ADD     #DUREQ-SNDRQ1-2,R4      ;POINTER TO DUREQ
        MOVB    (R4)+,R3        ;MESSAGE LENGTH + PAD
;*************************************************
;* SEND A BLOCK ON THE LINK
;*************************************************
        MOV     #6,(R1)         ;SET DTR AND RTS
        MOV     #36000+SSYN,2(R1)       ;SET FOR DU-11 (INT SYNCHRONOUS-8 BIT)
        BR      2$
        .WORD   MRESERVED
        .WORD   RESERVED
2$:     BIT     #1000,(R1)      ;TEST FOR DSR
        BEQ     2$              ;NOT YET
1$:     BIT     #20000,(R1)     ;TEST FOR CTS
        BEQ     1$              ;NOT YET
        CMP     (R1)+,(R1)+     ;SET TO XMIT CSR
        BIS     #30,(R1)+       ;HDX AND SEND ON
SEND:   MOVB    (R4)+,(R1)      ;MOVE TO DEVICE BUFFER
STEST:  TSTB    -2(R1)          ;TEST FOR DONE
        BPL     STEST           ;NOT YET
        DEC     R3              ;DECREMENT COUNT
        BNE     SEND            ;MORE TO SEND
;*************************************************
;* RECEIVE A MESSAGE FROM THE LINK
;*************************************************
GETMSG: BIC     #20,-(R1)       ;DROP SEND
        CMP     -(R1),-(R1)     ;RESET TO RCV CSR AND CLR RCV BUFFER
        CLR     R4              ;BUFFER ADDR
        MOV     #8.,R3          ;HEADER LENGTH
        JSR     PC,RECV1        ;GET THE HEADER
        BNE     SNDREQ          ;NO GOOD CRC
```

```
107 020310  122527  000220          CMPB    (R5)+,#DLE      ;IS IT A DLE MESSAGE(LOC 0)
108 020314  001324                  BNE     SNDREQ          ;NO
109 020316  113703  000002          MOVB    @#2,R3          ;HIGH BYTE COUNT
110 020322  042703  177700          BIC     #177700,R3      ;CLEAR FLAGS AND OTHER BYTE
111 020326  000303                  SWAB    R3              ;SWAP BYTES
112 020330  152503                  BISB    (R5)+,R3        ;LOW BYTE COUNT(LOC 1)
113 020332  122323                  CMPB    (R3)+,(R3)+     ;ADD TWO FOR CRC
114 020334  005004                  CLR     R4              ;BUFFER ADDR
115 020336  004767  000026          JSR     PC,RECV         ;GET DATA FIELD
116 020342  001311                  BNE     SNDREQ          ;NO GOOD
117 020344  005715                  TST     (R5)            ;CHECK FOR CODE 0, LOAD 0 AT LOC 0
118 020346  001307                  BNE     SNDREQ          ;NO
119 020350  013700  017776          MOV     @#17776,R0      ;SAVE UNIT NUM FOR SECONDARY BOOT
120 020354  000137  000006          JMP     @#6             ;TRANSFER TO IT
121                         ;*************************************************
122                         ;* RECEIVE A BLOCK FROM THE LINK
123                         ;*************************************************
124 020360  042711  000024  RECV1:  BIC     #24,(R1)        ;CLEAR RTS AND SEARCH SYNC
125 020364  012711  000422          MOV     #422,(R1)       ;SET SEARCH,STRIP,DTR
126 020370  005005          RECV:   CLR     R5              ;INITIALIZE CRC
127 020372  000403                  BR      RTEST
128 020374  000000                  .WORD   0               ;FILLER
129 020376  056471                  .WORD   056471          ;CRC16 WORD FOR ROM #2
130 020400  177776                  .WORD   -2              ;HEADER WORD FOR ROM #3
131 020402  012702  000017  RTEST:  MOV     #15.,R2         ;LONG LOOP VALUE
132 020406  005046                  CLR     -(SP)           ;SHORT LOOP
133 020410  105711          2$:     TSTB    (R1)            ;TEST FOR DEVICE DONE
134 020412  100421                  BMI     RDONE           ;ALL DONE
135 020414  005316                  DEC     (SP)            ;DECREMENT SHORT LOOP
136 020416  001374                  BNE     2$              ;AGAIN
137 020420  005302                  DEC     R2              ;DECREMENT LONG LOOP
138 020422  000402                  BR      3$
139 020424  173000                  .WORD   MRESERVED
140 020426  000340                  .WORD   RESERVED
141 020430  001367          3$:     BNE     2$              ;KEEP GOING
142 020432  105706                  TSTB    SP              ;CHECK STACK AT OR BELOW 17400
143 020434  003256                  BGT     SNDRQ1          ;LOOP ONCE MOR(8 TIMES TOTAL)
144 020436  005011                  CLR     (R1)            ;DROP DTR-HANG UP
145 020440  012703  000012  HNGLOP: MOV     #10.,R3         ;LONG LOOP COUNTER
146 020444  005302          4$:     DEC     R2              ;DECREMENT SHORT LOOP
147 020446  001376                  BNE     4$              ;AGAIN
148 020450  005303                  DEC     R3              ;DECREMENT LONG LOOP
149 020452  001374                  BNE     4$              ;AGAIN
150 020454  000644                  BR      SNDREQ          ;HUNG UP LONG ENOUGH-ANSWER AGAIN
151 020456  005726          RDONE:  TST     (SP)+           ;CLEAN UP STACK-LOOP CTR
152 020460  042711  000400          BIC     #400,(R1)       ;NO STRIP SYNC
153 020464  116114  000002          MOVB    2(R1),(R4)      ;STORE IT
154 020470  112446          1$:     MOVB    (R4)+,-(SP)     ;BYTE TO ADD
155 020472  012702  000010          MOV     #8.,R2          ;NUMBER BITS PER BYTE
156 020476  000241          CRCLOP: CLC                     ;CLEAR CARRY
157 020500  006005                  ROR     R5              ;LOW BIT PARTIAL TO CARRY
158 020502  006016                  ROR     (SP)            ;CARRY TO BYTE AND BYTE TO CARRY
159 020504  102006                  BVC     1$              ;XOR OF PARTIAL AND BYTE(LOW BITS)
```

```
160 020506  012746  120001          MOV     #POLY,-(SP)     ;XOR POLY TO PARTIAL(4 INSTRUCTIONS)
161 020512  040516                  BIC     R5,(SP)         ;NOT PARTIAL AND POLY
162 020514  042705  120001          BIC     #POLY,R5        ;NOT POLY AND PARTIAL
163 020520  052605                  BIS     (SP)+,R5        ;POLY XOR PARTIAL
164 020522  005302              1$: DEC     R2              ;DECREMENT BIT COUNT
165 020524  003364                  BGT     CRCLOP          ;ONCE MORE
166 020526  005726                  TST     (SP)+           ;CLEAN UP STACK-BYTE TO ADD
167 020530  005303                  DEC     R3              ;DECREMENT BYTE COUNT
168 020532  003323                  BGT     RTEST           ;ONCE MORE
169 020534  005705                  TST     R5              ;SET CC
170 020536  000207                  RTS     PC              ;RETURN
171                             ;*******************************************************
172                             ;* DECNET BOOT REQUEST
173                             ;*******************************************************
174 020540     024     226     226 DUREQ:  .BYTE   20.,SSYN,SSYN,SSYN,DLE,4,300,0,0,1,021,120
    020543     226     220     004
    020546     300     000     000
    020551     001     021     120
175
176 020554     010     002     001         .BYTE   10,2,1,0,242,60         ;DUREQ REQUEST MESSAGE
    020557     000     242     060
177
178                             ;*******************************************************
179                             ;* FLOATING DEVICE MODULO
180                             ;*******************************************************
181 020562     007              DEVTAB: .BYTE   7               ;DJ11 DEVICE MODULUS
182 020563     017                      .BYTE   17              ;DH11
183 020564     007                      .BYTE   7               ;DQ11
184 020565     007                      .BYTE   7               ;DU11
185
186                                                             ;       ***NOTE***
                                                                ;THE NEXT 4 WORDS ARE ZERO FILLED
187 020576  075042              ENDBOO: .WORD   075042          ;CRC16 WORD FOR ROM #3
188                             ;*******************************************************
189                             ;* RELOCATION ROUTINE
190                             ;*******************************************************
191         020600                      .=20600
192 020600  012702  020000              MOV     #20000,R2
193 020604  012703  030000              MOV     #30000,R3
194 020610  012223              2$:     MOV     (R2)+,(R3)+
195 020612  020227  020576              CMP     R2,#20576
196 020616  001401                      BEQ     1$
197 020620  000773                      BR      2$
198 020622  000000              1$:     HALT
199         000001                      .END
```

SYMBOL TABLE

```
ASYN   = 000337        DUBGN   020000        HNGLOP  020440        RECV1   020360        SETSTK  020060
BDIAG    020054        DUREQ   020540        INITSW= 173024        RESERV= 000340        SNDREQ  020166
CRCLOP  020476        EMDU    020012        MRESER= 173000        RTEST   020402        SNDRQ1  020172
CRCWD  = 000000        ENDBOO  020576        NODEV   020040        R6     =%000006       SOH    = 000201
DEVTAB  020562        ENQ    = 000005        POLY   = 120001        R7     =%000007       SSYN   = 000226
DIAG   = 165564        FLOAT   020140        RDONE   020456        SEND    020252        STEST   020254
DLE    = 000220        GETMSG  020266        RECV    020370
```

```
                .REM    %

                                        IDENTIFICATION
                                        --------------

                PRODUCT CODE:           XXXXXXX-XX-XXXXX-X-X

                PRODUCT NAME:           M9312 DECNET BOOT - DUP11

                PRODUCT DATE:           APRIL 1978

                MAINTAINER:             DIAGNOSTIC ENGINEERING

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```
                        .REM    %
                             THIS ROM WILL BOOT THE DUP OPTION.
                        TO BOOT UNIT 0,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y04.
                        TO BOOT UNIT 0,AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y06.
                        TO BOOT UNIT 1,AND NOT RUN DIAGNOSTICS,THE START ADDR IS 173Y30.
                        TO BOOT UNIT 1,AND RUN CPU DIAGNOSTICS,THE START ADDR IS 173Y32.
                        THE Y COMPONENT OF THE ADDRESS REPRESENTS BITS 7 AND 8 OF THE WHOLE WORD.
                        IF ROM #1 IS IN SLOT 1 THE Y COMPONENT IS 00  ADDR. 1730XX
                        IF ROM #1 IS IN SLOT 2 THE Y COMPONENT IS 01  ADDR. 1732XX.
                        %


                        .TITLE  M9312 DECNET BOOT - DUP11
                        ;       BASIC DEFINITIONS

        000000          R0=%0
        000001          R1=%1
        000002          R2=%2
        000003          R3=%3
        000004          R4=%4
        000005          R5=%5
        000006          R6=%6
        000007          R7=%7
        000006          SP=%6
        000007          PC=%7
        000340          RESERVED=340
        165564          DIAG=165564
        173024          INITSW=173024
        000000          CRCWD=0
        173000          MRESERVED=173000
        000226          SSYN=226
        000220          DLE=220
        000337          ASYN=337
        000201          SOH=201
        000005          ENQ=005
        120001          POLY=120001
                        .NLIST  MC,MD
                        .LIST   ME


000000                          .ENABL  ABS
        020000                  .=20000
```

```
 1                                          ;*********************************************************
 2                                          ;* CMND XW (DUP11)
 3                                          ;*********************************************************
 4 020000     127     130          DUPBGN: .ASCII  'WX'              ;IDENTIFIER 'XW' FOR DUP11 BOOT
 5 020002  000576                         .WORD   <ENDBOO-.+2>      ;OFFSET TO NEXT BOOT
 6 020004  000261                         SEC                       ;ENTRY FOR DUP11, NO CPU DIAG RUN
 7 020006  012700  000000                 MOV     #0,R0             ;ENTRY FOR DUP11, RUN CPU DIAG
 8 020012  012701  160010          EMDUP: MOV     #160010,R1        ;PUT FLOATING BASE ADDR IN R1
 9 020016  010704                         MOV     PC,R4             ;GET RETURN ADDR
10 020020  103015                         BCC     BDIAG             ;GO TO DIAG IF ENABLED (C=0)
11 020022  000416                         BR      SETSTK
12 020024  173000                         .WORD   MRESERVED
13 020026  000340                         .WORD   RESERVED
14 020030  000261                         SEC                       ;ENTRY FOR UNIT 1, NO CPU DIAG RUN
15 020032  012700  000001                 MOV     #1,R0             ;ENTRY FOR UNIT 1, RUN CPU DIAG
16 020036  000765                         BR      EMDUP
17                                         ;*********************************************************
18                                         ;* FLOATING DEVICE INTERRUPT ROUTINE
19                                         ;*********************************************************
20 020040  005202          NODEV:  INC     R2                ;UPDATE R2 TO POINT TO NEXT DEV MODULO
21 020042  005303                  DEC     R3                ;SUB ONE FROM R3
22 020044  100002                  BPL     1$                ;IF CANT FIND DEVICE, HALT
23 020046  000000          2$:     HALT                      ;       ***NOTE***
24 020050  000776                  BR      2$                ;REVIEW FLOATING ADDRESS ASSIGNMENTS
25 020052  000002          1$:     RTI                       ;RETURN
26                                         ;*********************************************************
27                                         ;* GO TO DIAG
28                                         ;*********************************************************
29 020054  000137  165564  BDIAG:  JMP     @#DIAG            ;GO TO DIAG
30                                                           ;RETURN MADE THROUGH ADDR IN R4
31                                         ;*********************************************************
32                                         ;* FIND THE DEVICE IN FLOATING SPACE
33                                         ;*********************************************************
34 020060  012706  017776  SETSTK: MOV     #17776,SP         ;SET UP STACK
35 020064  042700  177760          BIC     #177760,R0        ;PREVENT TRYING TO BOOT UNIT # > 15
36 020070  010016                  MOV     R0,(SP)           ;SAVE UNIT NUM AT 17776
37 020072  010702          2$:     MOV     PC,R2             ;SET UP R2 WITH
38 020074  062702  000474          ADD     #DEVTAB-2$-2,R2   ;POINTER TO DEVTAB
39 020100  010704          3$:     MOV     PC,R4             ;SET UP R4 WITH
40 020102  062704  177736          ADD     #NODEV-3$-2,R4    ;POINTER TO TRAP ROUTINE
41                                                           ;       ***NOTE***
42                                                           ;THE NEXT FOUR INSTRUCTIONS VERIFY THAT
43                                                           ;THE EXTENSION ROMS ARE PROPERLY INSTALLED.
44                                                           ;IF NOT, THE BOOT WILL HALT
45 020106  011246                  MOV     (R2),-(SP)        ;PUSH THE #7407 FROM ROM #3 ON THE STACK
46 020110  166416  000202          SUB     202(R4),(SP)      ;SUBTRACT FROM IT THE #1775 OFF ROM #2
47 020114  022726  005412          CMP     #5412,(SP)+       ;COMP IT WITH #5412
48 020120  001402                  BEQ     4$                ;IF NOT EQUAL, HALT
49 020122  000000          5$:     HALT                      ;       ***NOTE***
50 020124  000776                  BR      5$                ;CHECK POS OF ROMS #2 AND #3
51 020126  012703  000006  4$:     MOV     #6,R3             ;TRAP PS ADDR
52 020132  005013                  CLR     (R3)              ;CLR NEW PSW
53 020134  010443                  MOV     R4,-(R3)          ;SET TRAP ROUTINE ADDR IN LOC 4
```

```
                                                        ;R3 CONTAINS DUP11 POS IN FLOAT SPACE
020136  005711                  FLOAT:  TST     (R1)            ;TEST FOR DEVICE, MAYBE TRAP TO NODEV
020140  111204                          MOVB    (R2),R4         ;MODULO INCREMENT
020142  060401                          ADD     R4,R1           ;UPDATE ADDRESS
020144  005201                          INC     R1              ;BY MODULO
020146  040401                          BIC     R4,R1           ;IN TABLE
020150  005703                          TST     R3              ;IS THIS A THE ONE?
020152  001371                          BNE     FLOAT           ;NOT YET
                                ;*******************************************************
                                ;* ADD UNIT DISPLACEMENT TO UNIT 0 CSR ADDR
                                ;*******************************************************
020154  006300                          ASL     R0              ;UNIT # TIMES 2
020156  006300                          ASL     R0              ;UNIT # TIMES 4
020160  006300                          ASL     R0              ;UNIT # TIMES 8
020162  060001                          ADD     R0,R1           ;CSR ADDR + UNIT*8
                                ;*******************************************************
                                ;* SETUP TO SEND MESSAGE
                                ;*******************************************************
020164  012706  017440          SNDREQ: MOV     #17400+<8.*4>,SP        ;SET STACK ADDR-17400+8 TIMES LOOP DEC.
020170  010704                  SNDRQ1: MOV     PC,R4           ;SET UP R4 WITH
020172  000403                          BR      3$
020174  000000                          .WORD   0               ;FILLER
020176  024572                          .WORD   024572          ;CRC16 WORD FOR ROM #1
020200  177776                          .WORD   -2              ;HEADER WORD FOR ROM #2
020202  062704  000354          3$:     ADD     #DUPREQ-SNDRQ1-2,R4     ;POINTER TO DUPREQ
020206  112403                          MOVB    (R4)+,R3        ;MESSAGE LENGTH + PAD
                                ;*******************************************************
                                ;* SEND A BLOCK ON THE LINK
                                ;*******************************************************
020210  012711  000006                  MOV     #6,(R1)         ;SET DTR AND RTS
020214  012761  101226  000002          MOV     #101000+SSYN,2(R1)      ;SET FOR DUP-11 (DEC MODE-CRC INH)
020222  000402                          BR      2$
020224  173000                          .WORD   MRESERVED
020226  000340                          .WORD   RESERVED
020230  032711  001000          2$:     BIT     #1000,(R1)      ;TEST FOR DSR
020234  001775                          BEQ     2$              ;NOT YET
020236  032711  020000          1$:     BIT     #20000,(R1)     ;TEST FOR CTS
020242  001775                          BEQ     1$              ;NOT YET
020244  022121                          CMP     (R1)+,(R1)+     ;SET TO XMIT CSR
020246  052721  000030                  BIS     #30,(R1)+       ;HDX AND SEND ON
020252  012711  000626                  MOV     #400+SSYN,(R1)  ;START IT UP WITH TSOM
020256  000401                          BR      STEST           ;TEST FOR DONE
020260  112411                  SEND:   MOVB    (R4)+,(R1)      ;MOVE TO DEVICE BUFFER
020262  105761  177776          STEST:  TSTB    -2(R1)          ;TEST FOR DONE
020266  100375                          BPL     STEST           ;NOT YET
020270  005303                          DEC     R3              ;DECREMENT COUNT
020272  001372                          BNE     SEND            ;MORE TO SEND
                                ;*******************************************************
                                ;* RECEIVE A MESSAGE FROM THE LINK
                                ;*******************************************************
020274  042741  000020          GETMSG: BIC     #20,-(R1)       ;DROP SEND
020300  024141                          CMP     -(R1),-(R1)     ;RESET TO RCV CSR AND CLR RCV BUFFER
020302  005004                          CLR     R4              ;BUFFER ADDR
```

```
107 020304  012703  000010              MOV     #8.,R3          ;HEADER LENGTH
108 020310  004767  000052              JSR     PC,RECV1        ;GET THE HEADER
109 020314  001323                      BNE     SNDREQ          ;NO GOOD CRC
110 020316  122527  000220              CMPB    (R5)+,#DLE      ;IS IT A DLE MESSAGE(LOC 0)
111 020322  001320                      BNE     SNDREQ          ;NO
112 020324  113703  000002              MOVB    @#2,R3          ;HIGH BYTE COUNT
113 020330  042703  177700              BIC     #177700,R3      ;CLEAR FLAGS AND OTHER BYTE
114 020334  000303                      SWAB    R3              ;SWAP BYTES
115 020336  152503                      BISB    (R5)+,R3        ;LOW BYTE COUNT(LOC 1)
116 020340  122323                      CMPB    (R3)+,(R3)+     ;ADD TWO FOR CRC
117 020342  005004                      CLR     R4              ;BUFFER ADDR
118 020344  004767  000036              JSR     PC,RECV         ;GET DATA FIELD
119 020350  001305                      BNE     SNDREQ          ;NO GOOD
120 020352  005715                      TST     (R5)            ;CHECK FOR CODE 0, LOAD 0 AT LOC 0
121 020354  001303                      BNE     SNDREQ          ;NO
122 020356  013700  017776              MOV     @#17776,R0      ;SAVE UNIT NUM FOR SECONDARY BOOT
123 020362  000137  000006              JMP     @#6             ;TRANSFER TO IT
124                             ;*******************************************************
125                             ;* RECEIVE A BLOCK FROM THE LINK
126                             ;*******************************************************
127 020366  042711  000024      RECV1:  BIC     #24,(R1)        ;CLEAR RTS AND SEARCH SYNC
128 020372  000403                      BR      1$
129 020374  000000                      .WORD   0               ;FILLER
130 020376  024437                      .WORD   024437          ;CRC16 WORD FOR ROM #2
131 020400  177776                      .WORD   -2              ;HEADER WORD FOR ROM #3
132 020402  012711  000422      1$:     MOV     #422,(R1)       ;SET SEARCH,STRIP,DTR
133 020406  005005              RECV:   CLR     R5              ;INITIALIZE CRC
134 020410  012702  000017      RTEST:  MOV     #15.,R2         ;LONG LOOP VALUE
135 020414  005046                      CLR     -(SP)           ;SHORT LOOP
136 020416  105711              2$:     TSTB    (R1)            ;TEST FOR DEVICE DONE
137 020420  100421                      BMI     RDONE           ;ALL DONE
138 020422  000402                      BR      1$
139 020424  173000                      .WORD   MRESERVED
140 020426  000340                      .WORD   RESERVED
141 020430  005316              1$:     DEC     (SP)            ;DECREMENT SHORT LOOP
142 020432  001371                      BNE     2$              ;AGAIN
143 020434  005302                      DEC     R2              ;DECREMENT LONG LOOP
144 020436  001367                      BNE     2$              ;KEEP GOING
145 020440  105706                      TSTB    SP              ;CHECK STACK AT OR BELOW 17400
146 020442  003252                      BGT     SNDRQ1          ;LOOP ONCE MOR(8 TIMES TOTAL)
147 020444  005011                      CLR     (R1)            ;DROP DTR-HANG UP
148 020446  012703  000012      HNGLOP: MOV     #10.,R3         ;LONG LOOP COUNTER
149 020452  005302              4$:     DEC     R2              ;DECREMENT SHORT LOOP
150 020454  001376                      BNE     4$              ;AGAIN
151 020456  005303                      DEC     R3              ;DECREMENT LONG LOOP
152 020460  001374                      BNE     4$              ;AGAIN
153 020462  000640                      BR      SNDREQ          ;HUNG UP LONG ENOUGH-ANSWER AGAIN
154 020464  005726              RDONE:  TST     (SP)+           ;CLEAN UP STACK-LOOP CTR
155 020466  042711  000400              BIC     #400,(R1)       ;NO STRIP SYNC
156 020472  116114  000002              MOVB    2(R1),(R4)      ;STORE IT
157 020476  112446              1$:     MOVB    (R4)+,-(SP)     ;BYTE TO ADD
158 020500  012702  000010              MOV     #8.,R2          ;NUMBER BITS PER BYTE
159 020504  000241              CRCLOP: CLC                     ;CLEAR CARRY
```

```
160 020506  006005                         ROR     R5              ;LOW BIT PARTIAL TO CARRY
161 020510  006016                         ROR     (SP)            ;CARRY TO BYTE AND BYTE TO CARRY
162 020512  102006                         BVC     1$              ;XOR OF PARTIAL AND BYTE(LOW BITS)
163 020514  012746  120001                 MOV     #POLY,-(SP)     ;XOR POLY TO PARTIAL(4 INSTRUCTIONS)
164 020520  040516                         BIC     R5,(SP)         ;NOT PARTIAL AND POLY
165 020522  042705  120001                 BIC     #POLY,R5        ;NOT POLY AND PARTIAL
166 020526  052605                         BIS     (SP)+,R5        ;POLY XOR PARTIAL
167 020530  005302                 1$:     DEC     R2              ;DECREMENT BIT COUNT
168 020532  003364                         BGT     CRCLOP          ;ONCE MORE
169 020534  005726                         TST     (SP)+           ;CLEAN UP STACK-BYTE TO ADD
170 020536  005303                         DEC     R3              ;DECREMENT BYTE COUNT
171 020540  003323                         BGT     RTEST           ;ONCE MORE
172 020542  005705                         TST     R5              ;SET CC
173 020544  000207                         RTS     PC              ;RETURN
174                                 ;*********************************************************
175                                 ;* DECNET BOOT REQUEST
176                                 ;*********************************************************
177 020546     024     226     226 DUPREQ: .BYTE   20.,SSYN,SSYN,SSYN,DLE,4,300,0,0,1,021,120
    020551     226     220     004
    020554     300     000     000
    020557     001     021     120
178
179 020562     010     012     001         .BYTE   10,10.,1,0,43,362       ;DUPREQ REQUEST MESSAGE
    020565     000     043     362
180
181                                 ;*********************************************************
182                                 ;* FLOATING DEVICE MODULO
183                                 ;*********************************************************
184 020570     007                 DEVTAB: .BYTE   7               ;DJ11 DEVICE MODULUS
185 020571     017                         .BYTE   17              ;DH11
186 020572     007                         .BYTE   7               ;DQ11
187 020573     007                         .BYTE   7               ;DU11
188 020574     007                         .BYTE   7               ;DUP11
189 020575     000                         .BYTE   0               ;FILLER
190
191 020576  036074                 ENDBOO: .WORD   036074          ;CRC16 WORD FOR ROM #3
192                                 ;*********************************************************
193                                 ;* RELOCATION ROUTINE
194                                 ;*********************************************************
195         020600                          .=20600
196 020600  012702  020000                  MOV     #20000,R2
197 020604  012703  030000                  MOV     #30000,R3
198 020610  012223                  2$:     MOV     (R2)+,(R3)+
199 020612  020227  020576                  CMP     R2,#20576
200 020616  001401                          BEQ     1$
201 020620  000773                          BR      2$
202 020622  000000                  1$:     HALT
203         000001                          .END
```

SYMBOL TABLE

```
ASYN  = 000337        DUPBGN  020000        HNGLOP  020446        RECV1   020366        SETSTK  020060
BDIAG   020054        DUPREQ  020546        INITSW= 173024        RESERV= 000340        SNDREQ  020164
CRCLOP  020504        EMDUP   020012        MRESER= 173000        RTEST   020410        SNDRQ1  020170
CRCWD = 000000        ENDBOO  020576        NODEV   020040        R6    =%000006        SOH   = 000201
DEVTAB  020570        ENQ   = 000005        POLY  = 120001        R7    =%000007        SSYN  = 000226
DIAG  = 165564        FLOAT   020136        RDONE   020464        SEND    020260        STEST   020262
DLE   = 000220        GETMSG  020274        RECV    020406
```